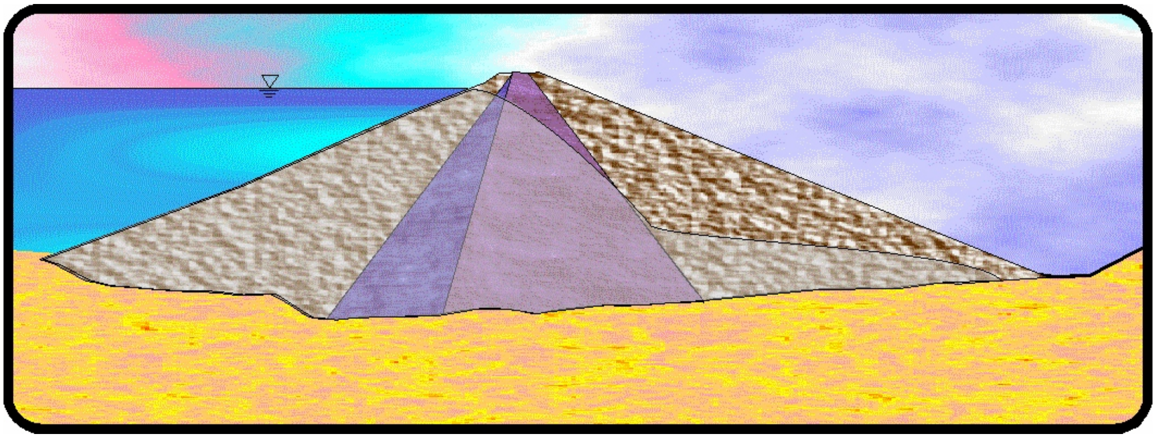
April 2003

FIRST INTERIM
SURVEILLANCE REPORT
Jan 2001-Nov 2002
LEROY ANDERSON DAM No. 72-9
Santa Clara County



Santa Clara Valley Water District

April 1, 2003

Mr. Stephen W. Verigin, Chief
Division of Safety of Dams
Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Subject: Leroy Anderson Dam, No. 72-9, Santa Clara County
Jan. 2001-Nov. 2002, First Interim Surveillance Report

Dear Mr. Verigin:

Please find enclosed two copies of our summary report for Leroy Anderson Dam covering the period from January 2001 to November 2002. This report includes an analysis of data from 2 pneumatic piezometers, 2 spillway underdrain seepage weirs, 16 dam crest survey monuments, and 3 spillway training wall survey monuments. Interpretation of the surveillance data from Anderson dam and the District's field observations confirm acceptable performance of the dam and spillway for the period of this report. Piezometer and weir data will continue to be measured monthly, and crest monuments will be surveyed annually.

On September 13, 2001, the dam was inspected by various District staff, including the authors of this report, in addition to Mr. Andy Mangney and Param Dhillon, engineers with DSOD. Based on these field observations, and our interpretation of the instrumentation data presented herein, Anderson Dam appears to be performing satisfactorily.

If you have any questions or comments regarding our surveillance program in general, or this report in particular, please contact Mr. Richard L. Volpe, Senior Engineer, Dam Safety Group, Infrastructure Planning Unit, (408) 265-2607, extension 2602.

Sincerely,

Original signed by

David E. Hook, P.E.
Engineering Unit Manager
Water Utility Engineering Unit

Enclosures

cc: w/encl. R. Yep, Jeff Micko, R. Fields, S. Choy, D. Gilleland, J. Aguilera, S. Katric, Jose Ortiz, C. Fredrickson, D. Hook , R.L. Volpe, J. Nelson, M. Mooers, library, Records Management

FIRST INTERIM
SURVEILLANCE REPORT
Jan 2001-Nov 2002
LEROY ANDERSON DAM No. 72-9
Santa Clara County

Photo by R. Volpe, 11/19/02

State of California
Department of Water Resources
Division of Safety of Dams
P.O. Box 942836
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Prepared by:

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

April 2003

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Jan 2001-Nov 2002
LEROY ANDERSON DAM No. 72-9
Santa Clara County

The interpretation of the instrumentation and other relevant data presented in this report has involved the application of certain graphical and statistical interpretive techniques common to the geosciences and earth dam engineering professions. The conclusions presented in this report were developed upon evaluating the performance of all instruments and other pertinent data during the specified period, and represent the professional judgment of its authors. This report was submitted on April 1, 2003.

Report prepared by:

Original Signed by

James L. Nelson, C.E.G.
Associate Engineering Geologist
Infrastructure Planning Unit

Original Signed by

Michael Mooers, P.E.
Associate Engineer
Infrastructure Planning Unit

Quality Control/Quality Assurance

This report has been reviewed and approved for publication by the undersigned professional engineers. We attest and confirm that the report was prepared by the individuals who signed the report under our immediate direction and supervision and that the conclusions and recommendations presented herein are reasonable and supported by District management.

Reviewed and approved by:

Original Signed by

Richard L. Volpe, P.E., G.E.
Senior Engineer
Infrastructure Planning Unit

Original Signed by

David E. Hook, P.E.
Engineering Unit Manager
Infrastructure Planning Unit

Table of Contents

TEXT

Section No. *Title* *Page No.*

1.0 INTRODUCTION......1
2.0 PIEZOMETER DATA......2
3.0 SPILLWAY UNDERDRAIN WEIR DATA......2
4.0 SURVEY DATA......2
4.1 DAM CREST AND ABUTMENT MONUMENTS......3
4.2 SPILLWAY TRAINING WALL MONUMENTS......3
4.3 DISCUSSION OF DISPLACEMENT......3
5.0 SIGNIFICANT AND NOTEWORTHY SEISMICITY......4
6.0 ACCELEROMETERS......4
7.0 VISUAL INSPECTIONS......5
8.0 SURVEILLANCE PROGRAM......6
9.0 CONCLUSIONS......6
10.0 REFERENCES CITED......6

Tables

Table No. *Title* *Following page 8*

Table 1 Recent Piezometer Data
Table 2 Recent Weir Discharge Data Spillway Underdrains
Table 3-1 Transverse Survey Data Crest and Abutment Monuments
Table 3-2 Vertical, Northings, Eastings, and Displacement Vector Data - Crest and Abutment Monuments
Table 3-3 Vertical, Northings, Eastings, and Displacement Vector Data - Spillway Monuments
Table 4 USGS Acceleration Data from May 14, 2002 Gilroy Earthquake (page 5 of text)

Table of Contents (Cont.)

Figures

Figure No. Title Following tables

Figure 1 Topographic Map, Leroy Anderson Dam Surveillance Instrumentation
Figure 2 Cross Sections A-A' & B-B'
Figure 3 - Piezometric Levels - Embankment
Figure 4 - Weir Discharge Data - Spillway Underdrains
Figure 5 Vertical Displacements - Monuments at Downstream Edge of Crest
Figure 6 Vertical Displacements - Monuments at Upstream Edge of Crest
Figure 7 - Transverse Displacements - Monuments at Downstream Edge of Crest
Figure 8 - Transverse Displacements - Monuments at Upstream Edge of Crest
Figure 9 Displacement Vectors - Monuments at Downstream Edge of Crest
Figure 10 Displacement Vectors - Monuments at Upstream Edge of Crest
Figure 11 Vertical Displacements - Spillway Training Walls
Figure 12 Displacement Vectors - Spillway Training Walls
Figure 13 Regional Fault Map, Showing 5-13-02 4.9 M & other Noteworthy Earthquakes

APPENDICES

Appendix A Leroy Anderson Dam Post-Earthquake Survey Form Issued June 25, 2002

1.0 INTRODUCTION

This First Interim Report contains surveillance data collected from Anderson Dam, No. 72-9, from January 2001 through November 2002. As discussed in more detail in the following paragraph, this report represents the First Interim Report of monitoring and surveillance data for Anderson Dam, following presentation of our more extensive report issued in March 2001, which is hereafter referred to as the "First Summary Report".

Starting with the First Summary Report (March 2001), the District plans to issue surveillance reports in two general formats; consisting of in-depth Summary Reports and less in-depth Interim Reports. Summary Reports are intended to provide extensive analysis and evaluation of the surveillance data, along with detailed pertinent discussions of data analyses over a period of about 5 years. The purpose of Interim Reports is to present all new surveillance data collected over a period of about 1 year for review by the District and Division of Safety of Dams (DSOD). The focus of the Interim Reports will be to review the data for overall accuracy and to make assessments of general data trends. If any significant geotechnical or operational events have occurred (i.e., earthquakes, sustained elevated reservoir levels, significant operational or maintenance changes, or dam/instrumentation/monitoring changes), these will be addressed to the appropriate level in the interim reports. We will attempt to prepare Summary Reports about every five years, with three to four Interim Reports on a yearly basis between the Summary Reports. Therefore, we expect to publish our next (second) Summary Report in March 2006.

During the time period covered by this report, the Santa Clara Valley Water District (District) monitored 2 pneumatic piezometers in the dam, 2 spillway underdrain seepage weirs, 16 dam crest survey monuments, and 3 spillway training wall survey monuments. All new data covered in this report is presented in tabular form, and plotted to facilitate review.

The physical locations of instruments discussed herein are shown in plan in Figure 1, and in section on Figure 2.

Tables 1 through 3 summarize recent piezometer, weir, and surface monument survey data, respectively. All surveillance data are also shown graphically on Figures 3 through 12, and discussed later in the report.

For the period of this report, data were collected monthly at piezometers and weirs. Crest monuments were surveyed at the times indicated (typically every year to a year and a half).

All data have been adjusted for the current datum used by the District which is the North American Vertical Datum (NAVD) 1988, which is 2.80 feet higher than the old datum (NGVD).

Reported rainfall is from District Rain Gauge No. 41-2073, located a few hundred feet southeast of the left abutment of Leroy Anderson Dam.

2.0 PIEZOMETER DATA

Figure 3 is a plot of the piezometric surface elevations from January 1993 through November 2002. The recent data, from January 2001 to November 2002, obtained since our last report, is shown as a shaded region on Figure 3. No data were collected from the two piezometers during December 2001 through March 2002, due to problems with the pneumatic data collection instrument.

Reservoir elevations and monthly rainfall data are presented for reference.

The data indicates that fluctuations in piezometric levels generally correspond to fluctuations in reservoir level, and tend to fall within the typical ranges of historical levels.

3.0 SPILLWAY UNDERDRAIN WEIR DATA

Figure 4 is a plot of the previously measured flow from the two spillway underdrain weirs from May 1993 through December 1998, and more recently measured spillway weir discharge data, from April 2000 to November 2002. The recent data, from January 2001 to November 2002 obtained since our last report, is shown as a shaded region on Figure 4.

Reservoir elevations and monthly rainfall data are presented for reference.

Since the time of our last report, the data indicates that underdrain discharge rates have remained low to negligible while the reservoir level has declined from about elev. 600 in early 2001 to about elev. 525 in early 2003, consistent with historical response. It should be pointed out, however, that discharge readings from Weir 1 could be nominally low due to a loose flange where the collector pipe to the weir connects to the end of the spillway underdrain pipe.

4.0 SURVEY DATA

This report provides transverse displacement data for the crest and abutment monuments for the first time since original monuments were abandoned in 1988. Historically, monument surveys have included transverse monument displacement data for all District dams. Modifications to Anderson Dam in 1988 included raising of the dam crest 4 to 7 feet and widening of the spillway to accommodate new PMF requirements. Consequently, new monuments were installed along the crest and at the right and left abutments.

Beginning with the new monuments at Anderson Dam, the District began performing GPS surveys with data provided in the form of coordinates (Northings and Eastings). Previous transverse data consisted of offset displacements either upstream or downstream relative to the monument line established soon after the dam was constructed. To conform to the format of surveillance reports for other District dams, we decided to again provide transverse monument data. These data are calculated from the coordinate data using trigonometric relationships assuming stable reference points away from the dam at the right and left abutments. It should be noted that transverse displacement is not applicable to the training wall monuments because they are not aligned along a single line-of-sight.

4.1 Dam Crest and Abutment Monuments

The crest monuments generally alternate between the downstream edge and upstream edge of the crest. Data plots have been grouped as either “upstream edge” or “downstream edge”. Included in each group are the two monuments, #16 and #31, which are located on the right and left abutments, respectively, at the ends of the dam approximately along the projection of the centerline of the crest. The location of the surface monuments are shown on Figure 1.

Table 3-1 summarizes new vertical and transverse displacement data for the crest and abutment monuments. . Table 3-2 summarizes recent northings, eastings, and resultant vector displacement data for the crest and abutment monuments.

Figures 5 through 10 are recent plots of vertical and transverse displacements, and horizontal displacement vectors (northings and eastings) of surface monuments. The most recent data, obtained since our last report, from January 2001 to November 2002, is shown as a shaded region on the figures.

The data presented indicates that only minimal displacements have occurred during this reporting period. A brief discussion of overall movements is presented in section **4.3 Discussion of Displacements**.

4.2 Spillway Training Wall Monuments

Three survey monuments are located at the top of the spillway training walls, two on a wall on the left side of the spillway ogee (#14 and #15) and one on a wall on the right side of the ogee (#13) as shown on Figure 1.

Table 3-3 summarizes recent vertical, northings, eastings, and resultant vector survey data for the training wall monuments.

Figures 11 and 12 are plots of recent vertical and vector displacements, respectively. The most recent data, obtained since our last report, from January 2001 to November 2002, is shown as a shaded region on Figure 11.

4.3 Discussion of Displacement

The data from the new transverse displacement plots of crest and abutment monuments from 1992 to 2002 corroborates the general magnitudes of downstream displacement from vector displacements (Figures 9 and 10). These two sets of horizontal data indicate general downstream movement of all dam crest monuments, which appears to have stabilized since the January 29, 1997 survey. The beginning of lateral downstream crest monument movements appears to coincide with the crest modifications which included raising the crest 4 to 7 feet to accommodate new PMF spillway modifications. As previously mentioned, the present crest and abutment monuments were installed following the crest modifications.

The relative displacement vectors presented in Figures 9, 10, and 12 (for the downstream and upstream crest monuments, and spillway training wall monuments, respectively) indicate that the 2002 data show a slight change in the orientation of the movement vector of between about 0.03-ft and 0.05-ft to the south-southwest. All monuments along the crest appear to have been similarly affected. The change in vector orientation appears to be either a systematic survey error or related to regional tectonic displacement of survey reference points. The District is looking into this situation, and we will carefully evaluate 2003 survey data to track the trend in movement vectors.

5.0 SIGNIFICANT AND NOTEWORTHY SEISMICITY

On May 13, 2002, a magnitude 4.9 earthquake (MM) occurred on the Castro fault, a subsidiary of the Sargent fault in Castro Valley immediately west of Gavilan College. The earthquake epicenter was situated about 3 km southwest of Gilroy, California, and about 14 miles southwest of Anderson Dam, as shown on Figure 13. This earthquake has been informally named the "Gilroy" earthquake by the U.S.G.S.

Appendix A includes the District's new Post-Earthquake Survey form. The Form was developed in conjunction with our FERC, OES, and EAP reporting responsibilities. It is intended for use by District staff after significant earthquakes to assess the overall safety of Anderson Dam, but was not yet ready and available for use at the time of the Gilroy Earthquake.

As shown on Figure 13, since 1999 there were five noteworthy earthquakes with the following magnitude, date, distance, and direction from Anderson Dam. 1) ML 4.29 on January 18, 1999, 41 miles southwest; 2) ML 4.09 on March 23, 1999, 38 miles southwest; 3) ML 4.25 on March 11, 2000, 37 miles to the southwest; 4) ML 4.44 on February 25, 2001, 12 miles to the northwest; and 5) ML 4.67 on December 28, 2001, 42 miles to the southeast. Figure 15, indicates that these earthquakes occurred on the San Andreas fault (items 1, 2, and 5), Zayante-Vergeles fault (item 3), and Calaveras fault (item 4).

6.0 ACCELEROMETERS

As mentioned above, a significant earthquake with magnitude 4.9 occurred on May 13, 2002, near Gilroy, California, about 14 miles southwest of Anderson Dam. Acceleration data from the U.S.G.S. accelerometers located on the crest and downstream face of Leroy Anderson Dam are summarized below.

Table 4
USGS Acceleration Data from May 13, 2002 Gilroy Earthquake
Anderson Dam Accelerometers

Channel	Location	Orientation degrees from North	Accel cm/s/s	Accel g	Vel cm/s	Displ cm
1	Mid-dam,center	153	-40.87	-0.04	-1.30	0.06
2	Mid-dam, center	243	-97.33	-0.10	3.05	0.15
3	Mid-dam, right	63	106.30	0.11	-3.60	-0.16
4	Toe	333	-22.19	-0.02	0.71	-0.03
5	Toe	UP	-41.12	-0.04	1.21	0.06
6	Toe	63	61.47	0.06	-1.82	-0.10
7	Right crest	333	80.56	0.08	-2.95	-0.18
8	Right crest	UP	67.44	0.07	2.31	-0.12
9	Right crest	63	104.50	0.11	-4.02	-0.26
10	Center crest	333	45.33	0.05	-1.94	-0.11
11	Center crest	UP	-62.28	-0.06	2.35	0.10
12	Center crest	63	-109.30	-0.11	3.72	0.28
1	Crest	340	43.10	0.04	-1.51	-0.07
2	Crest	UP	37.57	0.04	-1.59	-0.07
3	Crest	250	-89.95	-0.09	-4.44	-0.29

Notes:
1) earthquake specifics=Mw 4.9, ML 5.2, 05/14/2002,
05:00 UTC, 05/13/2002 10:00 PM PDT, 36.967 N, 121.600 W, 7.6 km depth
2) reported by email from USGS Seismologist Christopher Stephens on 12/13/02
3) shaded areas show highest recorded accelerations
4) cm = centimeters, g = gravity acceleration, s = seconds.

As indicated on Table 4, maximum crest accelerations from the May 13, 2002, earthquake were about 0.10 and 0.11 g. in the vertical direction and 0.06 g in the horizontal direction with displacements ranging from 0.06 cm to 0.28 cm.

7.0 VISUAL INSPECTIONS

The following significant inspections were performed during the period of this report include:

- A September 13, 2001, semi-annual inspection of Anderson Dam and appurtenant facilities by DSOD engineers A. Mangney and P. Dhillon, and District employees R. Volpe, D. Hook, J. Aguilera, and J. Nelson.
- A May 15, 2002, annual FERC inspection by J. Aguilera, R. Volpe, M. Mooers, J. Nelson, F. Cordova, B. Cane, and C. Fredrickson.
- A November 19, 2002, helicopter reconnaissance of all District dams including Anderson Dam by R. Volpe and consultants Dr. Allen Marr, P.E. and Keith Ferguson, P.E. to review new instrumentation plans.

8.0 SURVEILLANCE PROGRAM

Overall, for the period of 2001 through 2002, there were no significant modifications of Anderson Dam or appurtenant structures, and no operational changes were made that would impact the surveillance data or its interpretation, except where noted.

The District will continue with its current operating procedures and scheduled surveillance plans. Piezometers will be read monthly and dam crest monuments will be surveyed annually. In addition, site inspections and monument surveys will be conducted after a significant earthquake or other potentially disruptive activity. We do not anticipate replacement or repair work to be required in the next annual reporting period.

9.0 CONCLUSIONS

Based on our review of the monitoring data presented herein, it appears that there have been no unusual or abnormal changes in the monitoring data during the subject reporting period. Our review of the surveillance data, and our periodic safety inspections, indicate that Anderson Dam appears to show normal responses to the environment, aging process, and external events.

It should be noted that the current Dam Instrumentation program, an expansion of efforts previously expended by the District, has scheduled for review the instrumentation currently installed at the dam. We prepared a draft report in January 2002 (Nelson and Volpe, 2002) titled "Preliminary Instrumentation Design of Ten Dams Owned and Operated by Santa Clara Valley Water District" that summarizes proposed new instrumentation at Anderson Dam. If approved by the District's Board, major additions to the instrumentation at Anderson Dam are scheduled for completion in 2006-2007.

At the request of the Federal Energy Regulatory Commission (FERC), the District has agreed to install a monitoring well near the downstream toe of Anderson Dam in order to measure and observe the presence of seepage. The well will be located directly downstream of the dam toe, near an existing paved parking area that is operated by the Santa Clara County Parks and Recreation, near Coyote Creek and Cochrane Road, due east of Morgan Hill, California. The District is currently scheduling the work and we anticipate the monitoring well will be installed in the summer of 2003.

10.0 REFERENCES CITED

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TABLE 1
Recent Piezometric Data
Leroy Anderson Dam

Date	Reservoir Level (ft)	PPA-1	PPA-2	Monthly* Rainfall (in)
		Piezometric Surface Elevation (ft)		
01/22/01	597.72	578.86	499.48	3.66
02/15/01	597.35	578.03	501.86	4.69
03/14/01	597.35	578.72	501.56	1.97
04/17/01	597.35	577.45	501.09	1.61
05/16/01	597.35	577.80	501.21	0.00
06/14/01	597.35	578.61	501.56	0.00
	No July readings-instrument in for repair			0.00
08/20/01	596.31	577.22	500.86	0.00
09/18/01	593.29	576.64	501.09	0.04
10/30/01	590.82	576.06	499.71	0.24
11/15/01	591.73	575.14	499.13	3.27
12/14/01	592.78	NR	NR	4.61
01/22/02	594.07	NR	NR	1.02
02/20/02	592.28	NR	NR	1.38
03/20/02	592.51	NR	NR	2.36
04/15/02	589.23	572.60	498.78	0.28
05/13/02	586.62	573.06	498.09	0.55
06/20/02	581.94	574.45	498.32	0.00
07/15/02	578.27	572.14	496.71	0.00
08/14/02	573.50	572.83	497.17	0.00
09/18/02	567.76	570.98	496.01	0.00
10/16/02	563.45	569.60	493.93	0.00
11/14/02	564.05	569.37	495.09	3.23

Notes:
1) basis of elevations is NAVD 1988 - values in this table are 2.8 feet higher than NGVD 1929
2) * = total rainfall at end of indicated month in Date column
3) NR = no readings collected

TABLE 2
Recent Weir Data - Spillway Underdrains

Leroy Anderson Dam

Date	Reservoir	Underdrain	flow (gpm)	Total flow
	Level (ft)	Weir No. 1	Weir No. 2	(gpm)
01/22/01	597.72	42.70	6.29	48.99
02/15/01	597.35	38.60	6.29	44.89
03/14/01	600.00	46.20	6.29	52.49
04/17/01	599.55	54.30	6.29	60.59
05/16/01	599.49	50.30	4.94	55.24
06/14/01	599.46	54.30	4.94	59.24
07/26/01	602.75	34.60	4.94	39.54
08/20/01	596.31	23.30	3.59	26.89
09/18/01	593.59	20.70	3.14	23.84
10/30/01	590.82	9.43	3.14	12.57
11/15/01	591.73	10.80	3.14	13.94
12/15/01	593.19	18.90	3.14	22.04
01/22/02	594.07	18.90	3.14	22.04
02/20/02	592.28	16.60	3.14	19.74
03/20/02	592.51	14.80	3.14	17.94
04/15/02	589.23	9.43	2.25	11.68
05/13/02	586.62	0.45	1.80	2.25
05/23/02	585.49	0.90	2.25	3.15
05/29/02	584.80	0.00	2.25	2.25
06/20/02	581.94	0.00	1.80	1.80
07/15/02	578.27	0.00	0.90	0.90
08/14/02	573.50	0.00	1.80	1.80
09/18/02	567.76	0.00	1.80	1.80
10/16/02	563.45	0.00	2.25	2.25
11/14/02	564.05	0.00	1.80	1.80

Notes:

1) basis of elevations is NAVD 1988 - values in this table are 2.8 feet higher than NGVD 1929
2) Weir No. 1 collects flow from the central portion of spillway
3) Weir No. 2 collects flow from the left side of the spillway

TABLE 3-1

Transverse Data -Crest and Abutment Monuments

Leroy Anderson Dam

Date	Dam Crest Monument Transverse Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
07/19/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/24/89	-0.04	-0.08	-0.01	-0.08	0.01	-0.07	0.00	-0.05	-0.10	-0.03	-0.08	-0.04	-0.06	-0.05	-0.06	-0.06
10/28/90	-0.04	-0.06	-0.01	-0.08	0.00	-0.05	0.02	-0.02	-0.08	0.02	-0.05	0.01	-0.04	-0.03	-0.04	-0.04
06/07/91	-0.04	-0.05	0.03	-0.07	0.01	-0.07	-0.01	-0.07	-0.09	0.00	-0.05	0.00	-0.04	-0.04	-0.05	-0.04
01/08/92	-0.04	-0.07	0.02	-0.06	0.03	-0.05	0.01	-0.06	-0.10	0.01	-0.06	-0.01	-0.05	-0.04	-0.06	-0.05
01/27/93	-0.04	-0.07	0.02	-0.06	0.03	-0.05	0.02	-0.05	-0.10	0.01	-0.04	0.01	-0.04	-0.03	-0.04	-0.04
11/01/94	-0.04	-0.07	-0.01	-0.12	-0.03	-0.14	-0.04	-0.11	-0.15	-0.03	-0.08	-0.02	-0.06	-0.04	-0.05	-0.05
12/05/94	-0.04	-0.07	0.00	-0.11	-0.02	-0.12	-0.03	-0.10	-0.15	-0.02	-0.08	-0.02	-0.06	-0.04	-0.06	-0.06
01/04/96	-0.04	-0.08	-0.02	-0.15	-0.06	-0.17	-0.08	-0.15	-0.19	-0.04	-0.11	-0.02	-0.08	-0.05	-0.07	-0.07
05/22/96	-0.04	-0.07	-0.04	-0.17	-0.09	-0.19	-0.09	-0.17	-0.23	-0.07	-0.13	-0.04	-0.09	-0.07	-0.08	-0.07
01/29/97	-0.10	-0.15	-0.10	-0.23	-0.15	-0.26	-0.14	-0.21	-0.25	-0.10	-0.14	-0.06	-0.09	-0.07	-0.08	-0.08
12/10/98	-0.12	-0.19	-0.17	-0.26	-0.20	-0.29	-0.16	-0.23	-0.29	-0.07	-0.11	-0.02	-0.08	-0.05	-0.08	-0.07
12/03/99	-0.12	-0.17	-0.12	-0.25	-0.17	-0.29	-0.16	-0.24	-0.29	-0.07	-0.12	-0.03	-0.09	-0.07	-0.08	-0.08
11/28/00	-0.15	-0.19	-0.13	-0.26	-0.19	-0.30	-0.18	-0.27	-0.31	-0.08	-0.13	-0.03	-0.08	-0.06	-0.08	-0.08
10/18/01	-0.16	-0.19	-0.14	-0.26	-0.18	-0.30	-0.18	-0.26	-0.30	-0.08	-0.14	-0.04	-0.10	-0.08	-0.10	-0.10
10/15/02	-0.17	-0.20	-0.15	-0.26	-0.18	-0.30	-0.18	-0.26	-0.30	-0.10	-0.16	-0.06	-0.14	-0.12	-0.14	-0.12

Notes:

1) Negative transverse displacement signifies downstream movement

2) Positive transverse displacement signifies upstream movement

3) Displacement is net displacement since 1988

W:\geology\Annual Dam Safety Reports\DSOD\Anderson Dam\2001-02 Report\ANDTAB3-1-03.xls

TABLE 3-2
Vertical, Northings, Eastings, and Displacement Vector Data - Crest and Abutment Monuments
Leroy Anderson Dam

Date	Monument Vertical Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
10/18/2001	0.01	-0.07	-0.08	-0.26	-0.20	-0.33	-0.29	-0.23	-0.36	-0.18	-0.15	-0.08	-0.03	-0.02	0.01	-0.01
10/15/2002	0.01	-0.07	-0.09	-0.27	-0.21	-0.34	-0.30	-0.23	-0.36	-0.19	-0.15	-0.09	-0.02	-0.01	0.01	0.00

Date	Monument Northings Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
10/18/2001	-0.11	-0.15	-0.15	-0.21	-0.18	-0.21	-0.13	-0.13	-0.17	-0.05	-0.11	-0.05	-0.10	-0.08	-0.10	-0.12
10/15/2002	-0.18	-0.23	-0.21	-0.28	-0.24	-0.26	-0.18	-0.19	-0.23	-0.10	-0.17	-0.10	-0.17	-0.16	-0.17	-0.18

Date	Monument Eastings Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
10/18/2001	-0.10	-0.12	-0.06	-0.17	-0.10	-0.21	-0.12	-0.21	-0.24	-0.12	-0.14	-0.06	-0.09	-0.07	-0.08	-0.06
10/15/2002	-0.08	-0.09	-0.04	-0.13	-0.06	-0.18	-0.09	-0.19	-0.22	-0.10	-0.11	-0.03	-0.06	-0.05	-0.05	-0.01

Date	Monument Resultant Vector Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
10/18/2001	0.15	0.19	0.16	0.27	0.21	0.30	0.18	0.25	0.30	0.13	0.18	0.08	0.13	0.11	0.13	0.13
10/15/2002	0.20	0.25	0.22	0.31	0.25	0.32	0.21	0.27	0.31	0.15	0.20	0.11	0.18	0.17	0.18	0.18

Notes:

1) Negative vertical displacement represents settlement
2) Positive vertical displacement represents heave
3) Negative Northing displacement represents southern movement
4) Postive Northing displacement represents northern movement
5) Negative Easting displacement represents western movement
6) Positive Easting displacement represents eastern movement
7) NR = monument survey data not recorded
8) Displacement is net movement since 1988
9) Resultant vectors calculated by vector addition of Northings & Eastings

W:\geology\Annual Dam Safety Reports\DSOD\Anderson Dam\2001-02 Report\ANDTAB3-2-03.xls

TABLE 3-3
Vertical, Northings, Eastings, and Displacement Vector Data - Spillway Monuments
Leroy Anderson Dam

Date	Monument Vertical Displacement (feet)		
	13	14	15
10/18/2001	0.03	-0.01	0.00
10/15/2002	NR	-0.01	0.00

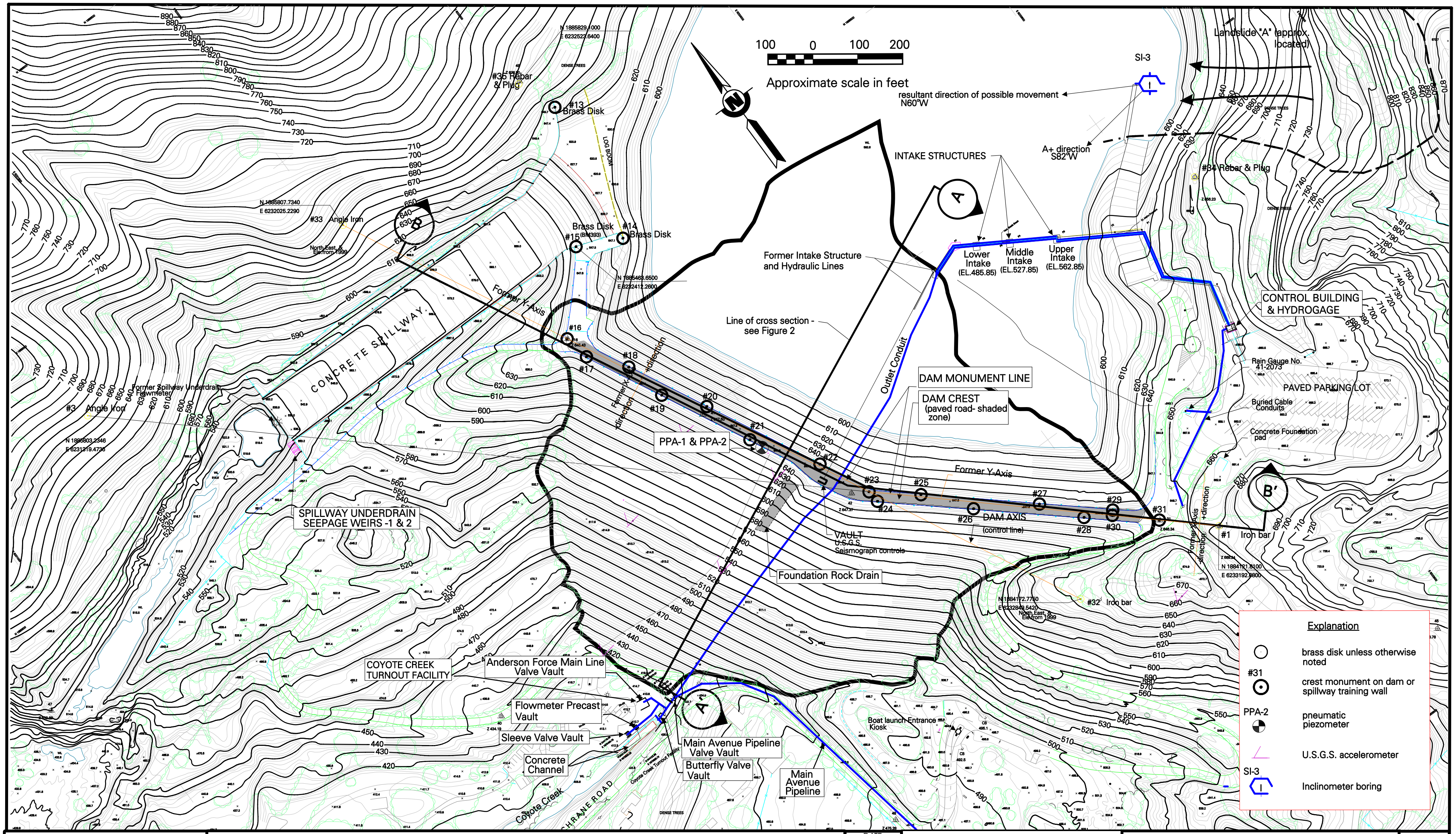
Date	Monument Northings Displacement (feet)		
	13	14	15
10/18/2001	-0.11	-0.08	-0.06
10/15/2002	NR	-0.16	-0.13

Date	Monument Eastings Displacement (feet)		
	13	14	15
10/18/2001	-0.02	-0.03	-0.04
10/15/2002	NR	-0.02	-0.05

Date	Monument Resultant Vector Displacement (feet)		
	13	14	15
10/18/2001	0.11	0.09	0.07
10/15/2002	NR	0.16	0.14

Notes:

1) Negative vertical displacement represents settlement
2) Positive vertical displacement represents heave
3) Negative Northing displacement represents southern movement
4) Postive Northing displacement represents northern movement
5) Negative Easting displacement represents western movement



Reference information and notes:
1) This map is a compilation of aerial mapping, survey field data, and digitized construction maps. Maximum error could be ± one foot vertical and horizontal
2) Grid is based on California Coordinate System, Zone III, NAD 83.
3) Elevations based on N.G.S. Vertical datum, NAVD 88. The DE between NAVD 29 and NGVD 88 is 2.80'
4) Photogrammetric mapping: Transvision, Photo date 12/11/97
5) file W:\geology\annual dam safety report\dsod\anderson dam\2001-02 report\andfigure1b.cdr

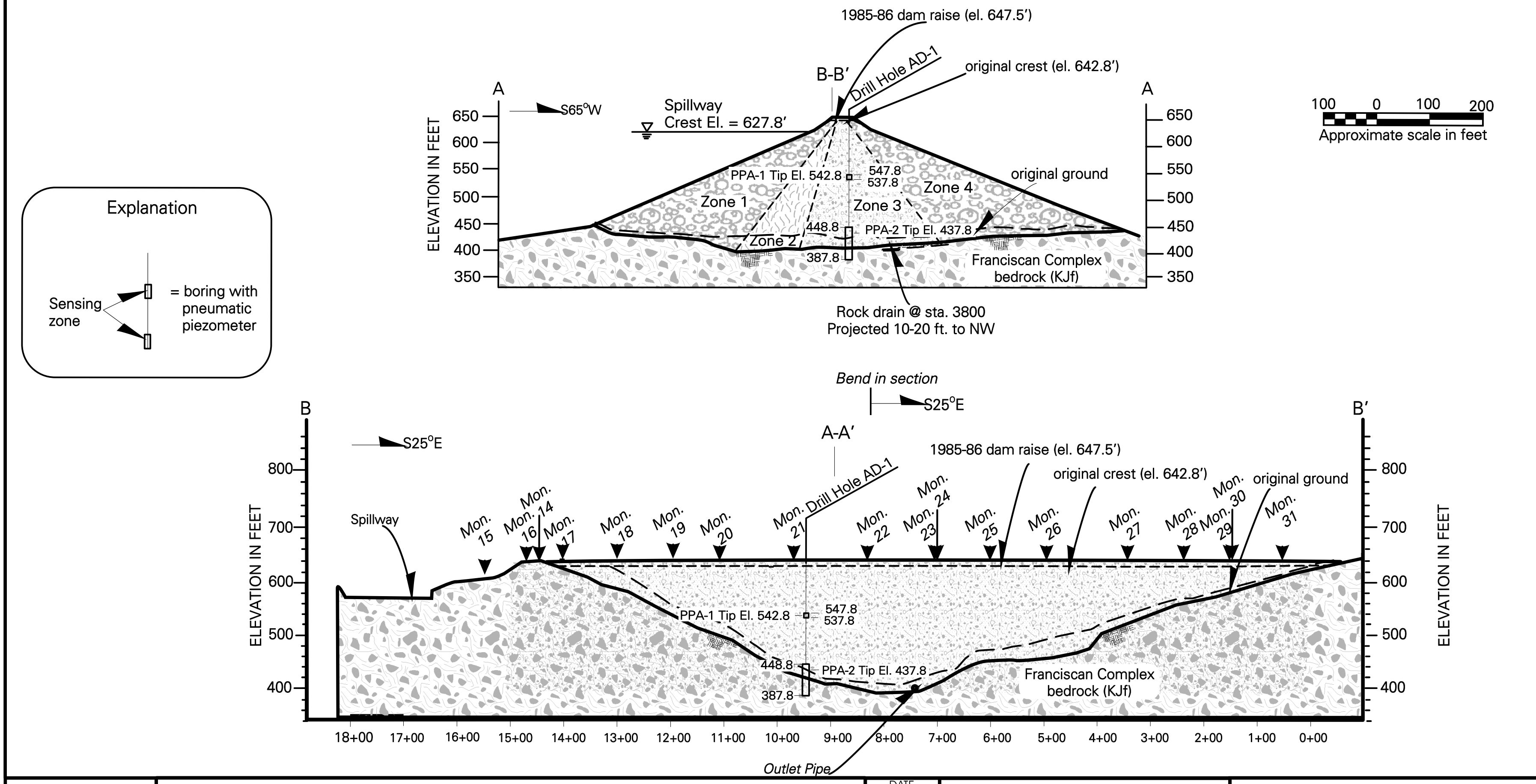
DATE	03/24/03
DESIGN	JLN
DRAWN	BLS
CHECKED	JLN

Santa Clara Valley Water District

Topographic Map
Leroy Anderson Dam (No. 72-9)
Surveillance Instrumentation

SCALE
1" = 200'

FIGURE
1



Note: 1) basis of elevation is NAVD 1988 -
elevations on this section are 2.8 feet higher
than those dated earlier than 1998
2) file: W:/geology/annual dam safety reports/dsod/anderson/2001-02 report/annewf2.cdr

DATE
12/02/00
DESIGN
JLN
DRAWN
JLN
CHECKED
RLV

Santa Clara Valley Water District

Cross Sections A-A' & B-B'

Leroy Anderson Dam (No. 72-9)

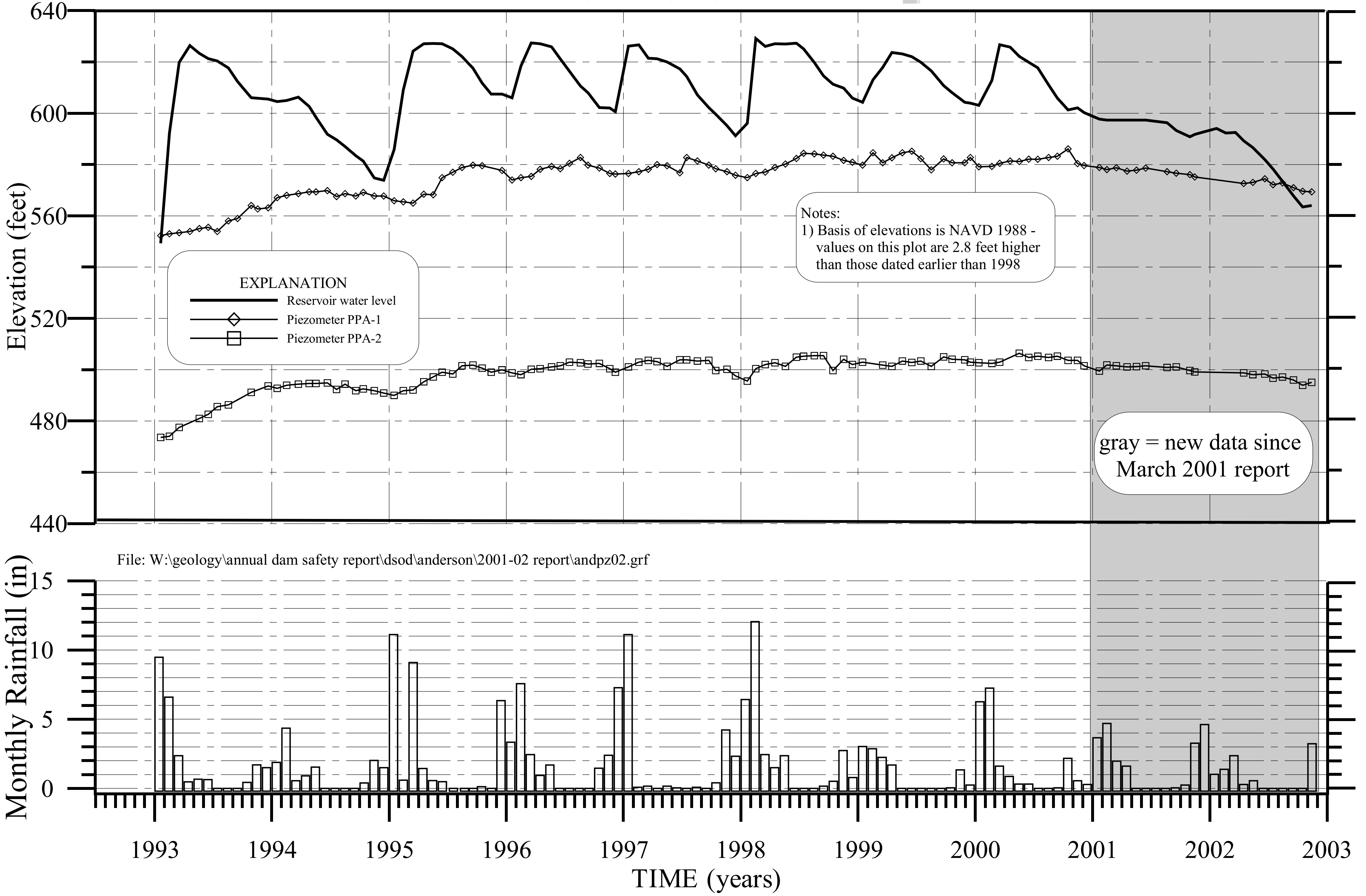
Piezometer Locations

SCALE
1" = 200'

FIGURE
2

LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District



Notes:
1) Basis of elevations is NAVD 1988 - values on this plot are 2.8 feet higher than those dated earlier than 1998

File: W:\geology\annual dam safety report\dsod\anderson\2001-02 report\andpz02.grf

Figure 3. Piezometric Levels - Embankment

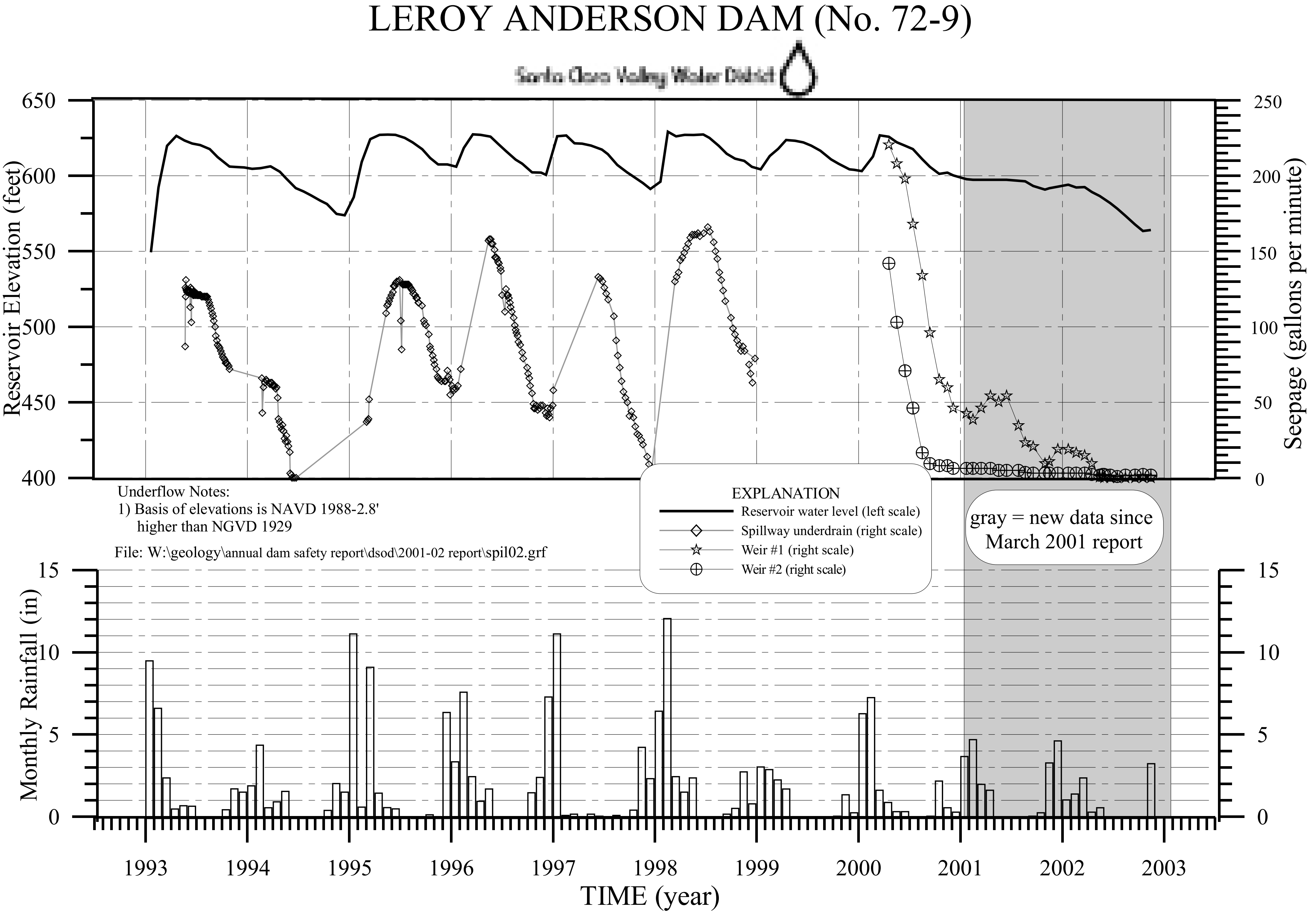
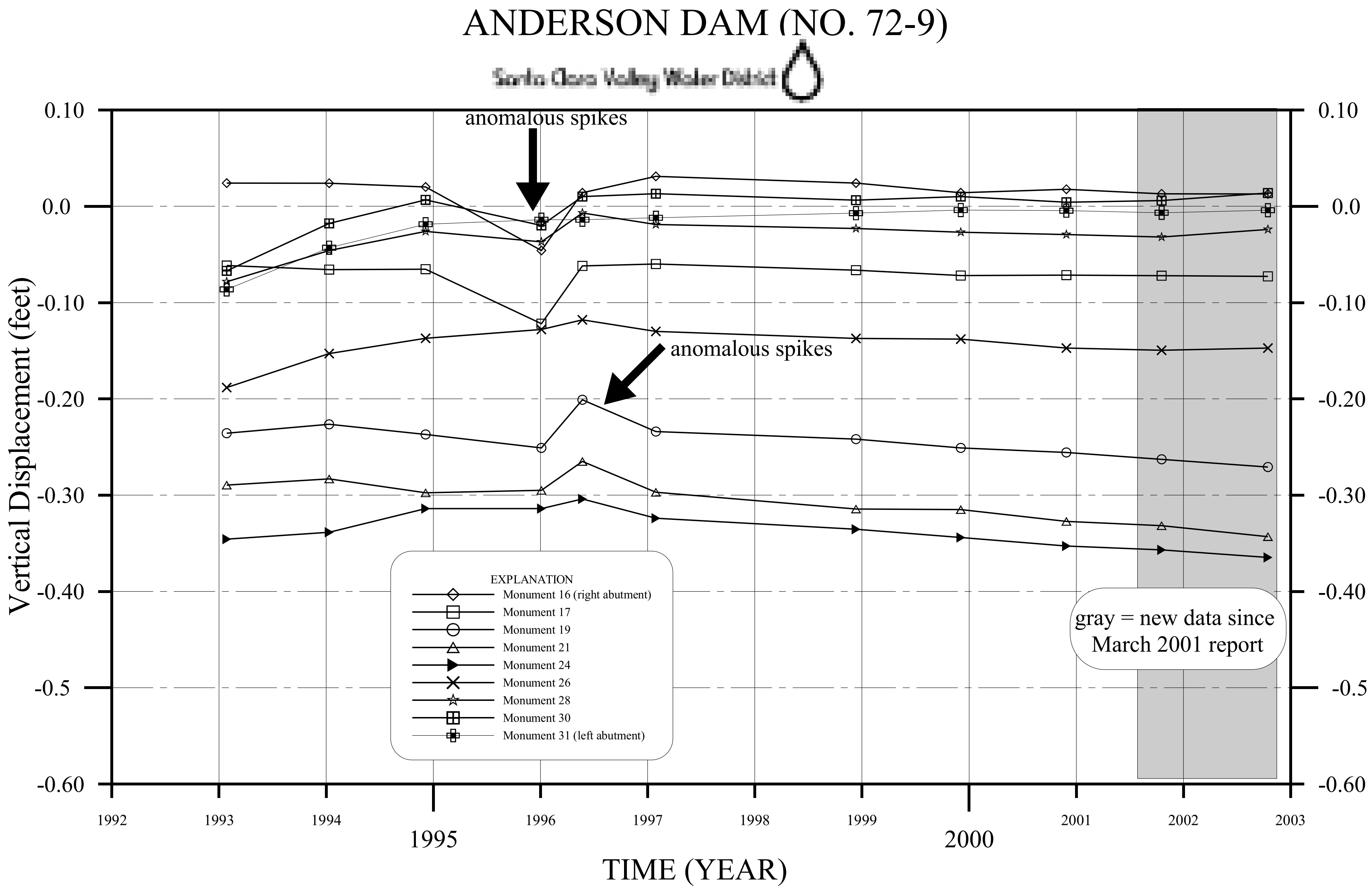


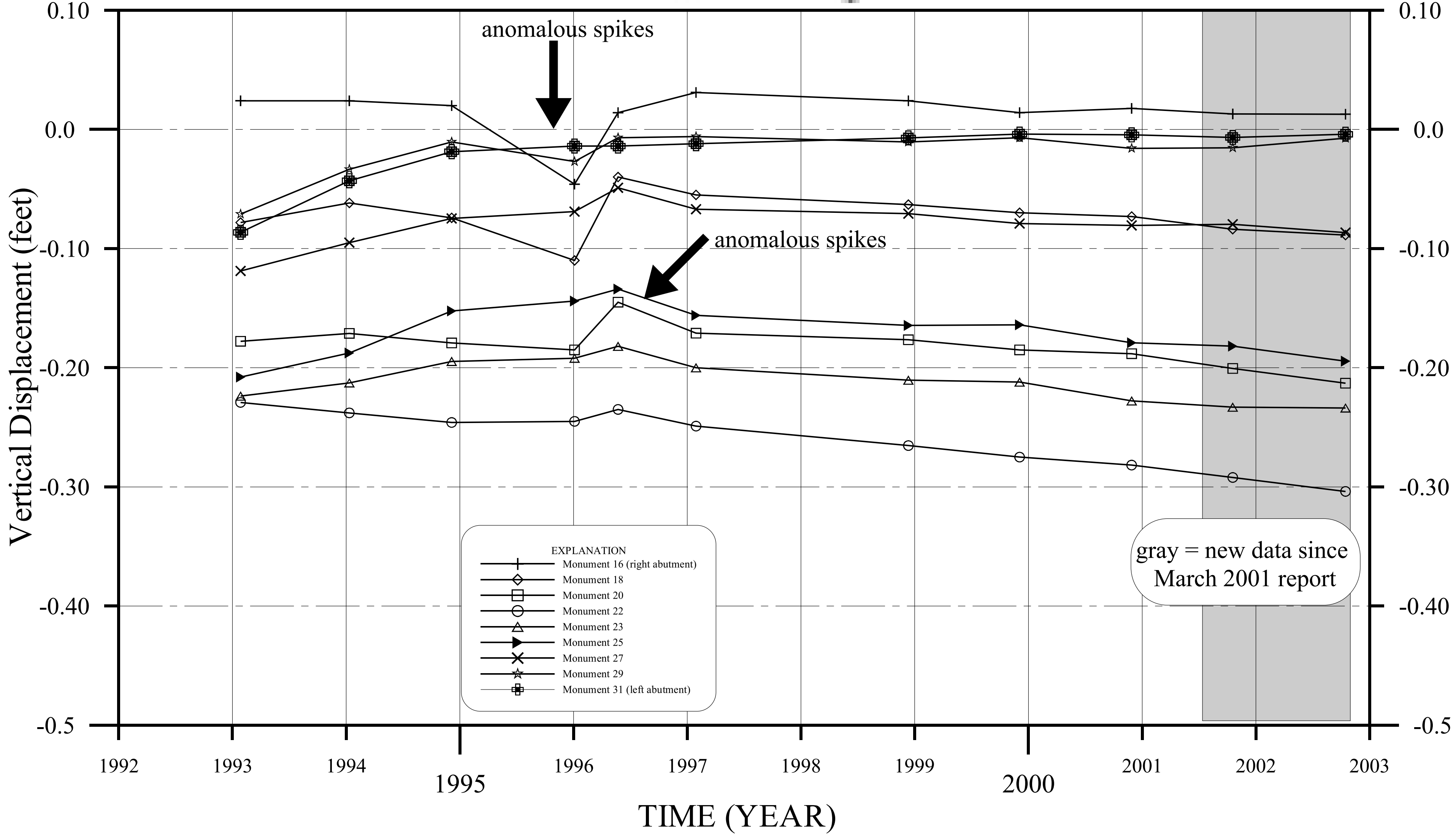
Figure 4 - Weir Discharge Data - Spillway Underdrains



File W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andvert1-03.grf

Figure 5 - Vertical Displacements - Monuments at Downstream Edge of Crest

ANDERSON DAM (NO. 72-9)

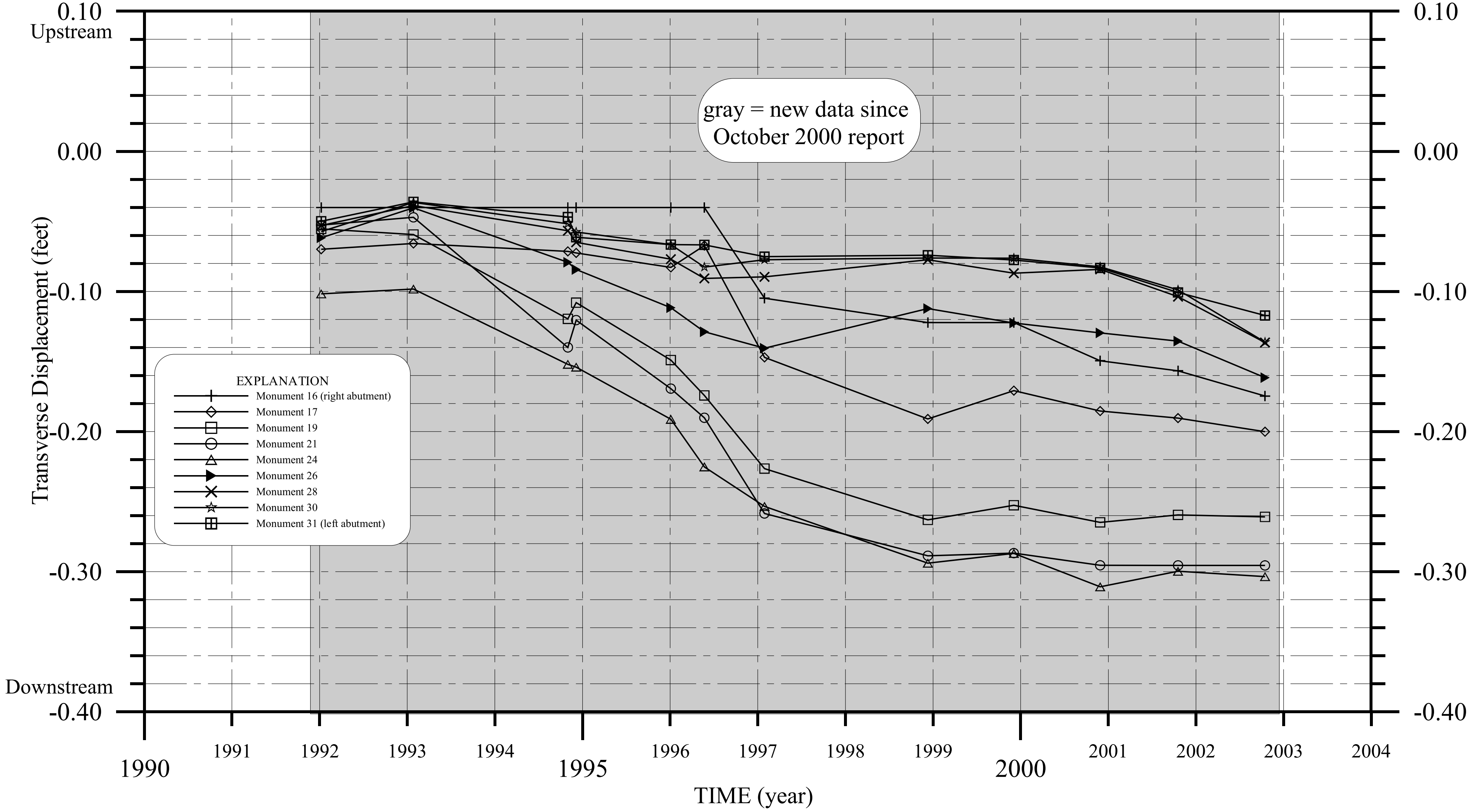


File W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andvert2-03.grf

Figure 6 - Vertical Displacements - Monuments at Upstream Edge of Crest

ANDERSON DAM (NO. 72-9)

Santa Clara Valley Water District

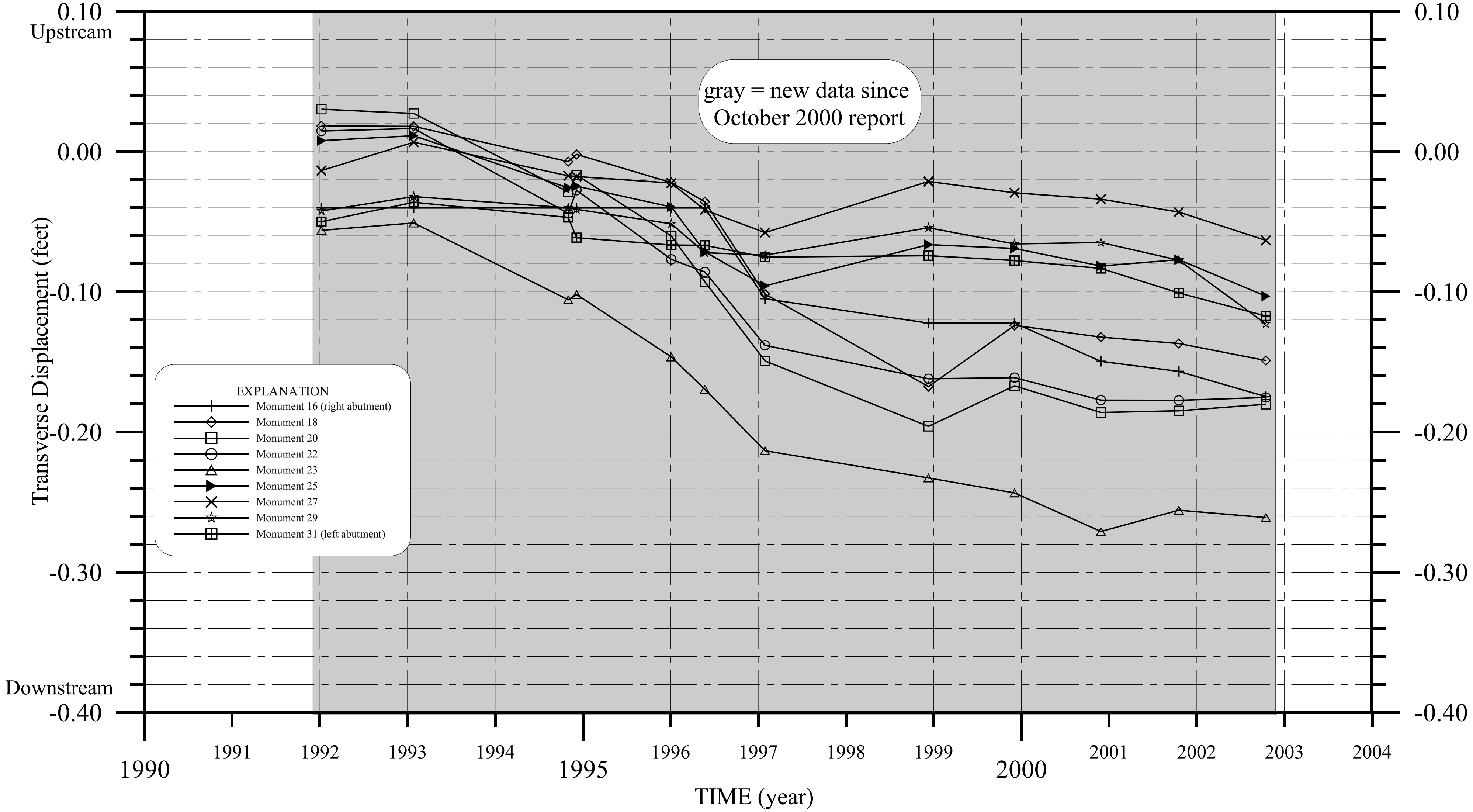


File: W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andla10y-03.grf

Figure 7 - Transverse Displacements - Monuments at Downstream Edge of Crest

ANDERSON DAM (NO. 72-9)

Santa Clara Valley Water District

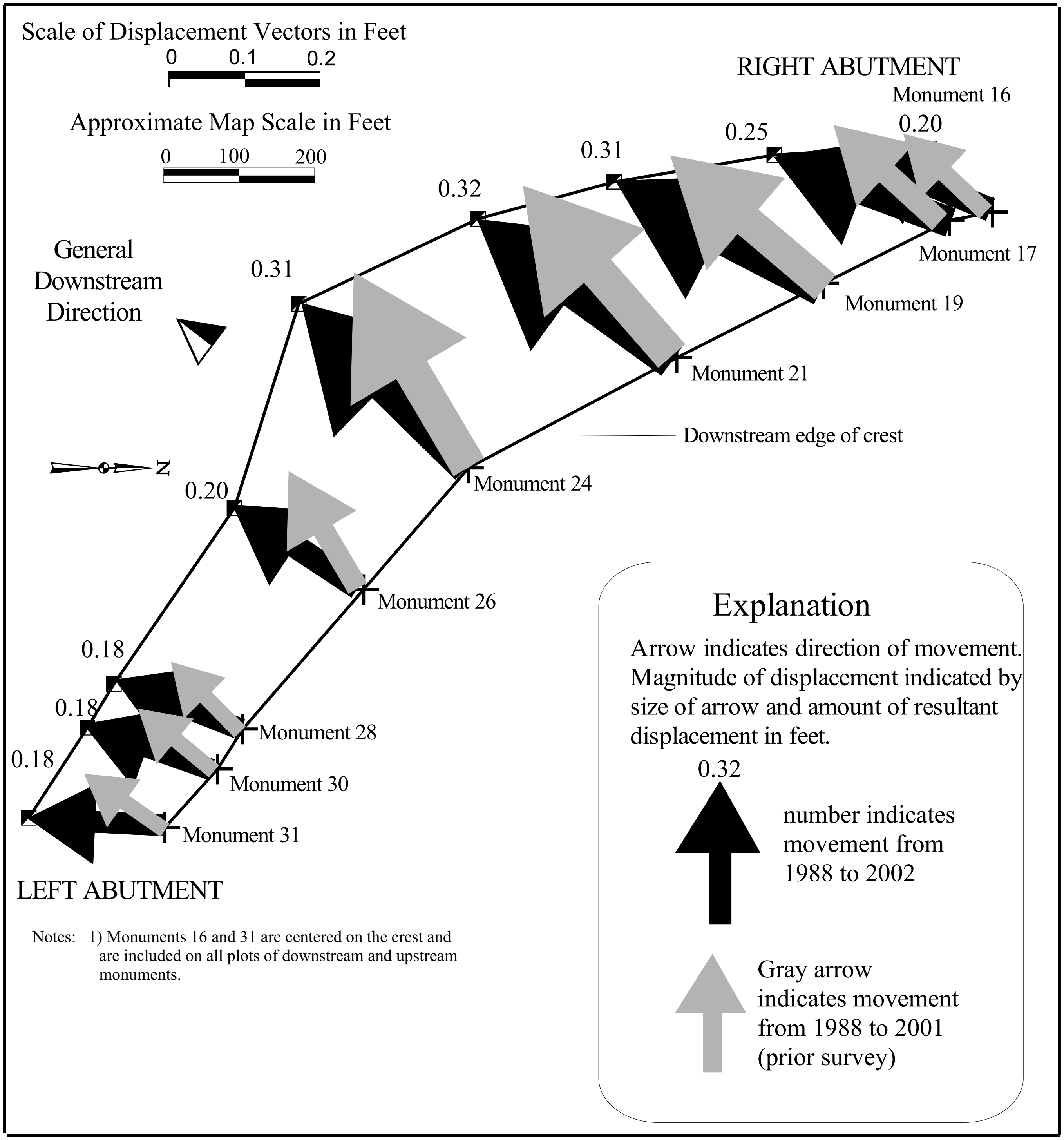


File: W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andl10y-03.grf

Figure 8 - Transverse Displacements - Monuments at Upstream Edge of Crest

LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District



Arrow indicates direction of movement. Magnitude of displacement indicated by size of arrow and amount of resultant displacement in feet.

number indicates movement from 1988 to 2002

Gray arrow indicates movement from 1988 to 2001 (prior survey)

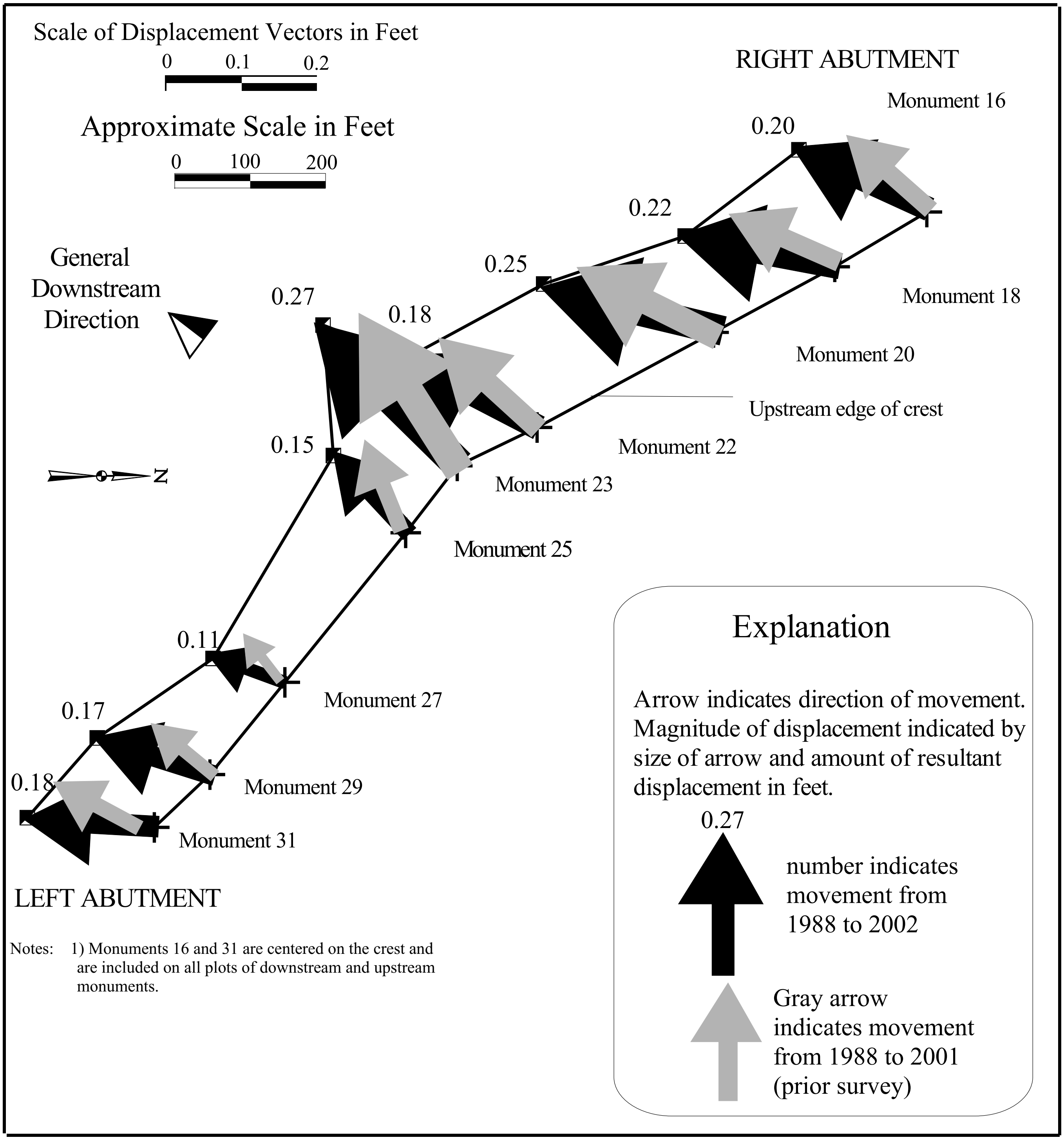
Notes: 1) Monuments 16 and 31 are centered on the crest and are included on all plots of downstream and upstream monuments.

File: W:\geology\annual dam safety reports\dsod\2001-02 report\andvect1-03.grf

Figure 9 - Displacement Vectors - Monuments at Downstream Edge of Crest

LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District



Arrow indicates direction of movement. Magnitude of displacement indicated by size of arrow and amount of resultant displacement in feet.

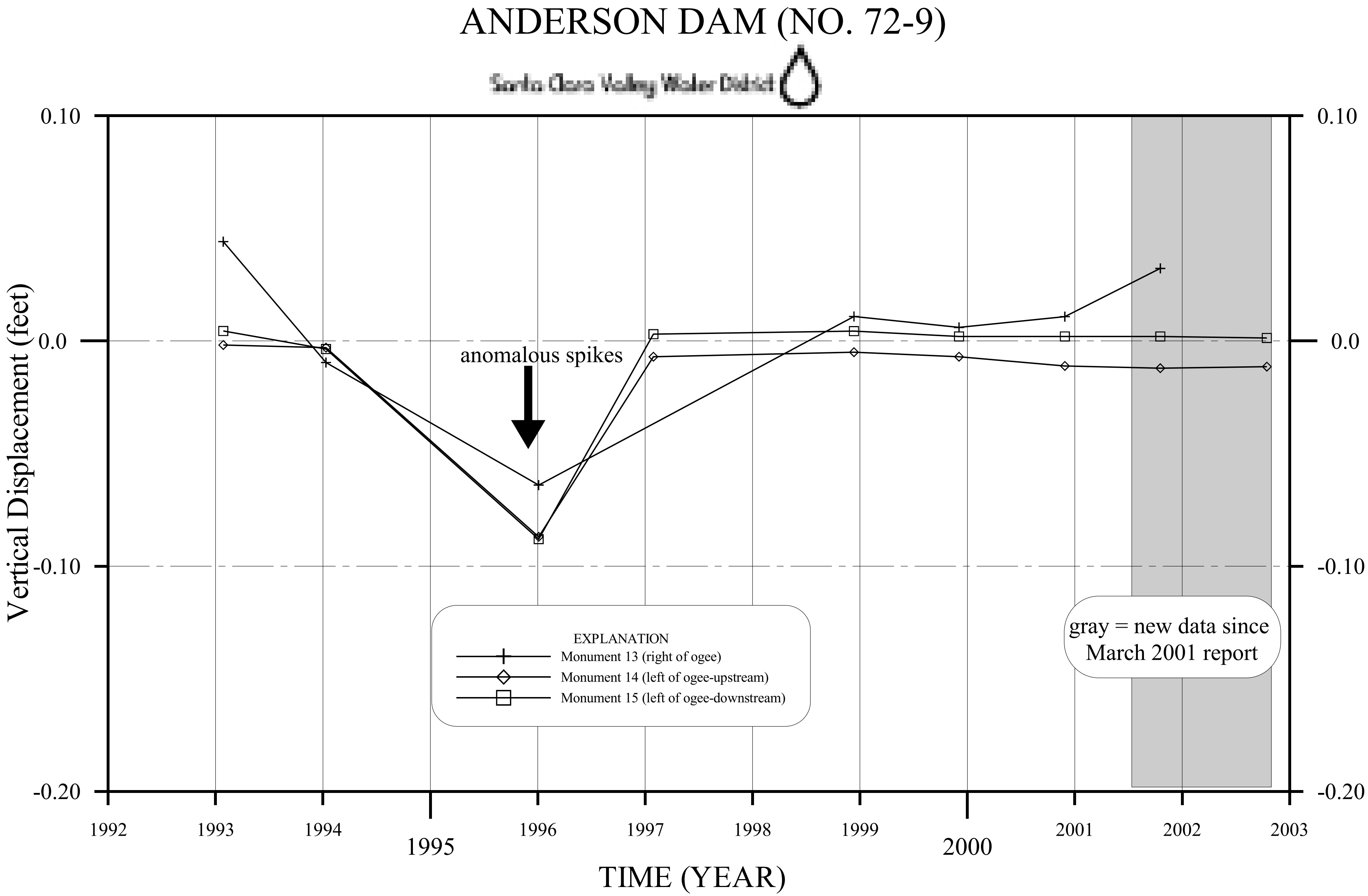
number indicates movement from 1988 to 2002

Gray arrow indicates movement from 1988 to 2001 (prior survey)

Notes: 1) Monuments 16 and 31 are centered on the crest and are included on all plots of downstream and upstream monuments.

File: W:\geology\annual dam safety reports\dsod\2001-02 safety report\vect3-03 .grf

Figure 10 - Displacement Vectors - Monuments at Upstream Edge of Crest

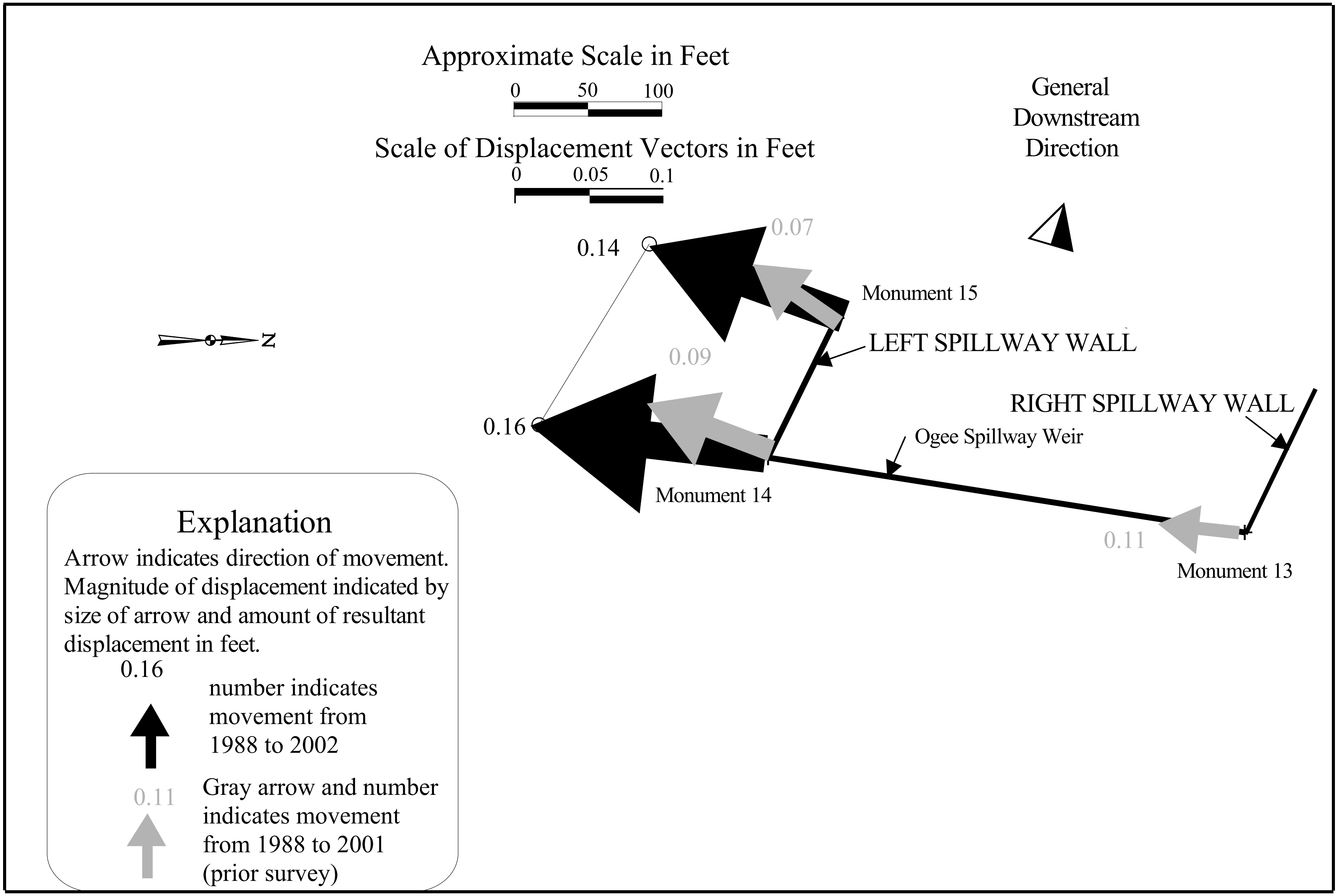


File W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andvert3-03.grf

Figure 11 - Vertical Displacements - Spillway Training Walls

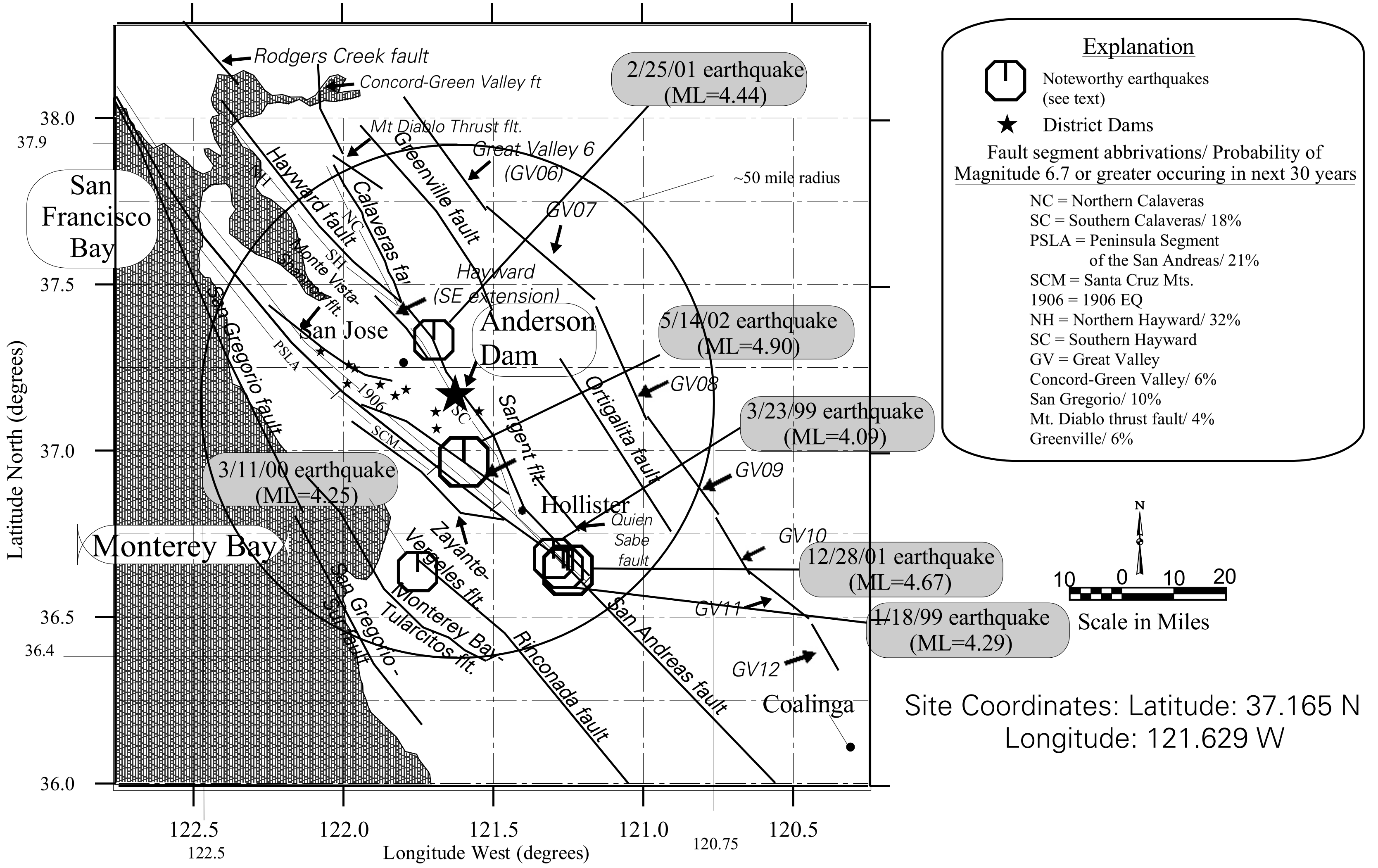
LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District


Approximate Scale in Feet
0
50
100
Scale of Displacement Vectors in Feet
0
0.05
0.1
General
Downstream
Direction
N
0.14
0.07
Monument 15
LEFT SPILLWAY WALL
0.09
0.16
RIGHT SPILLWAY WALL
Ogee Spillway Weir
Monument 14
0.11
Monument 13
Explanation
Arrow indicates direction of movement.
Magnitude of displacement indicated by size of arrow and amount of resultant displacement in feet.
0.16
number indicates movement from 1988 to 2002
0.11
Gray arrow and number indicates movement from 1988 to 2001 (prior survey)

File: W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\andvect5-03.grf

Figure 12 -Displacement Vectors - Spillway Training Walls



Notes: 1) File W:\geology\annual dam safety reports\dsod\anderson\2001-02 report\seismic\andseis-03.grf

DATE	12/11/02
DESIGN	JLN
DRAWN	JLN
CHECKED	RLV

Santa Clara Valley Water District

Regional Fault Map, Showing 5/13/02 4.9M and other Noteworthy Earthquakes

Anderson Dam (No. 72-9)

SCALE
1"=20'

FIGURE
13

Appendix A

Leroy Anderson Dam
Post-Earthquake Survey Form
Issued June 25, 2002

Leroy Anderson Dam

Post-Earthquake
Survey Report Form

Standard Operating Procedures
For Survey Team Member(s)

June 25, 2002

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118
(408) 265-2600

Purpose

The purpose of this survey document is to aid the inspector in performing a post-earthquake preliminary survey of Anderson Dam and to assist determining if the facility poses an immediate threat to public safety.

Narrative

When earthquakes equal to or exceeding magnitude 5.0 (M5.0) occur within 20 miles of the dam, trained and equipped District staff are dispatched to affected dams to perform a quick survey and report their findings to either the Rinconada Water Treatment Plant or the EOC.

Activation

Post-earthquake preliminary survey teams are self-activated when any of the following conditions occur:

> Earthquakes rated at or greater than 5.0 Richter Magnitude or greater within 20 miles of District dams;
>
> Any earthquake felt strongly enough to realize it lasted for more than ten seconds.

Post-earthquake preliminary survey teams may also be activated by the District whenever conditions exist that management believes warrant safety inspections of dams.

Leroy Anderson Dam
Description

Location: Coyote Creek watershed, downstream of Coyote Dam
DSOD No. 72-9, FERC Project No. 5737-CA
Coordinates: Lat. 37.165N, Long. -121.629W
Dam Height: 240 ft.
Dam Crest Length: 1,385 ft.
Maximum Storage Capacity: 89,073 acre-feet
Dam Crest Elevation: 646.4 to 647.4 ft.
Spillway Crest Elevation: 627.8 ft. (elevations based on NGVD 1988 datum)

PRE-DEPLOYMENT CHECKLIST

Ensure tools, checklists, and staff always ready for impromptu deployment.

Participate in regular communications equipment drills.

Attend regular training sessions.

Ensure coverage by alternate staff when primary off line.

DEPLOYMENT CHECKLIST

Attempt to validate trigger event by listening to news reports or going online- if in doubt, deploy anyway!

Deploy to dam immediately after a trigger event occurs.

Notify control (Rinconada or EOC) immediately by radio when deployment activated (in service).

Maintain an active radio watch at all times when in service.

Notify control (Rinconada or EOC) immediately by radio when destination reached and initial perception of situation.

Notify control (Rinconada or EOC)) anytime preliminary survey reveals a RED FLAG CONDITION.

Conduct dam preliminary survey in the sequence suggested below.

PRELIMINARY DAM SURVEY CHECKLIST(S)

See Figure 1, Anderson Dam Site and Vicinity Map, in Appendix (end of document)

Priority # 1 - OUTLET PIPE (Refer to Figure 1, Appendix C)

Need to add photo

Inspect the outlet pipe for the following RED FLAG CONDITION(s):

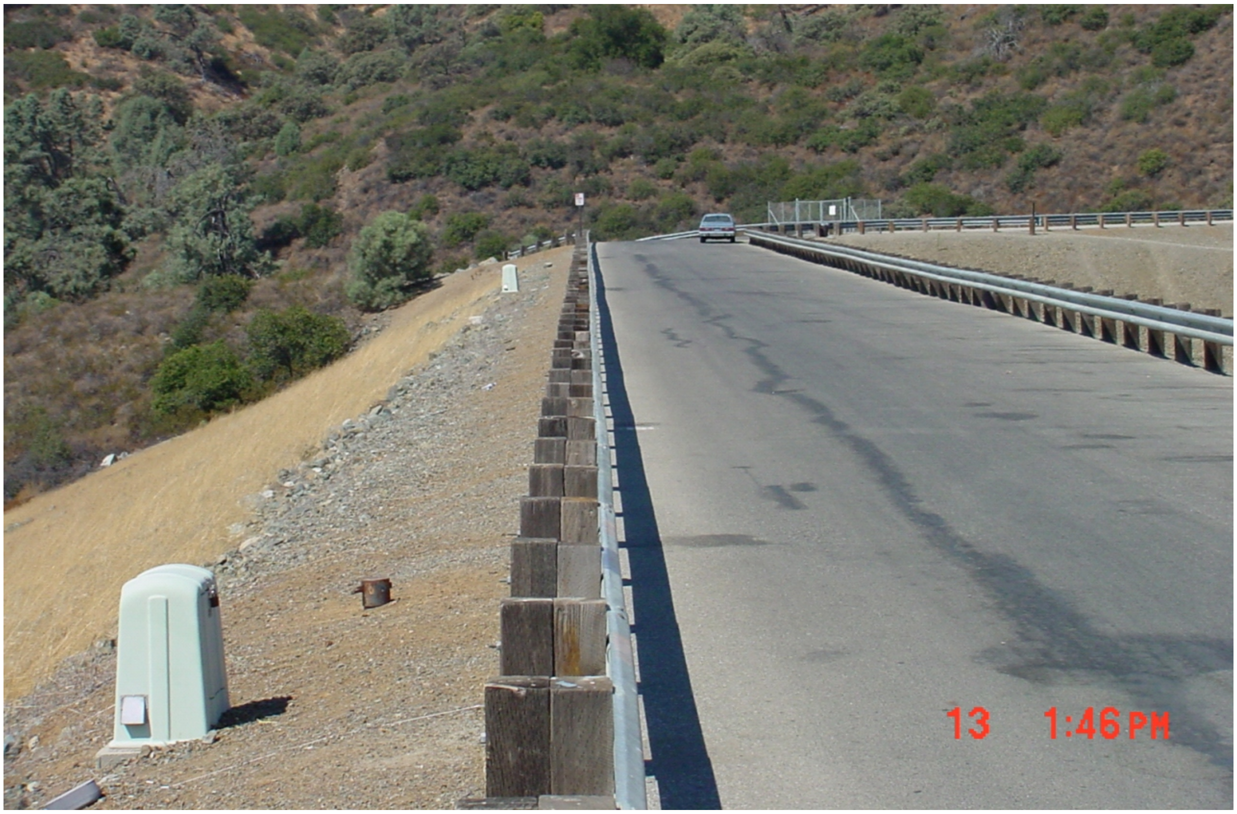
(A) [ ] At the outlet pipe discharge area, observe the end of the outlet pipe and note or estimate any change in water exiting the pipe since last observed (quantity, color/turbidity, and odor).
Is the discharge water clear or muddy?____
Is the discharge constant, increasing or decreasing?____
Estimate rate of discharge at first inspection ______________date:_________time:____________
Estimated rate of discharge at later time_________________ date:__________time:___________

Anderson Dam Historic Seepage: Seepage from the dam has never been observed near the toe area. Seepage does occur, however, beneath the spillway along the bedrock foundation in response to changes in reservoir elevation. Recently, two seepage weirs were constructed at the spillway terminus. The weirs have not yet (spring, 2002) been subjected to full reservoir conditions.

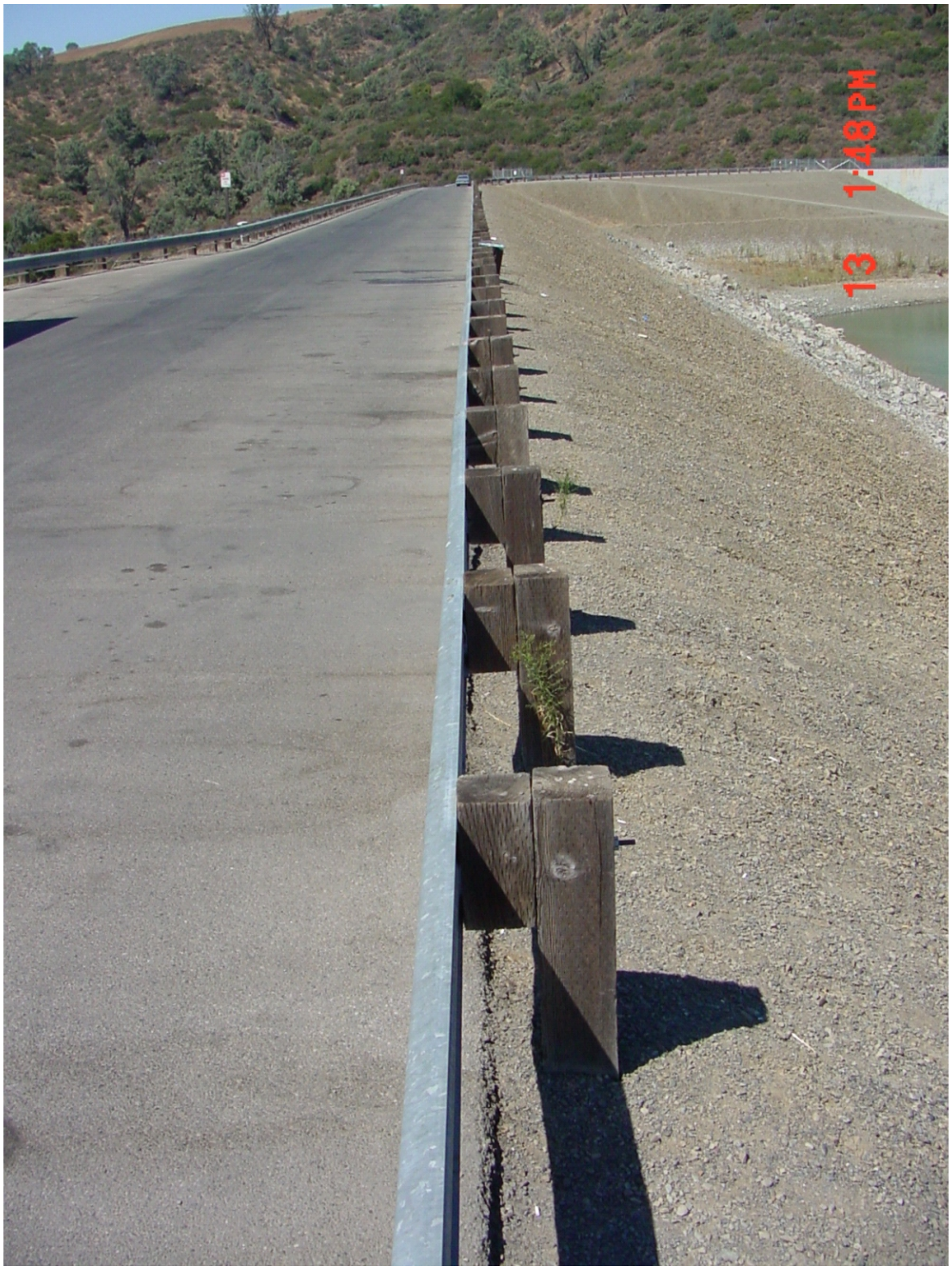
PRELIMINARY DAM INSPECTION CHECKLIST(S)

Priority # 2 - DAM CREST and FACE (Refer to Figure 1, Appendix C)

Inspect Dam Crest (Refer to Figure 1, Appendix C)

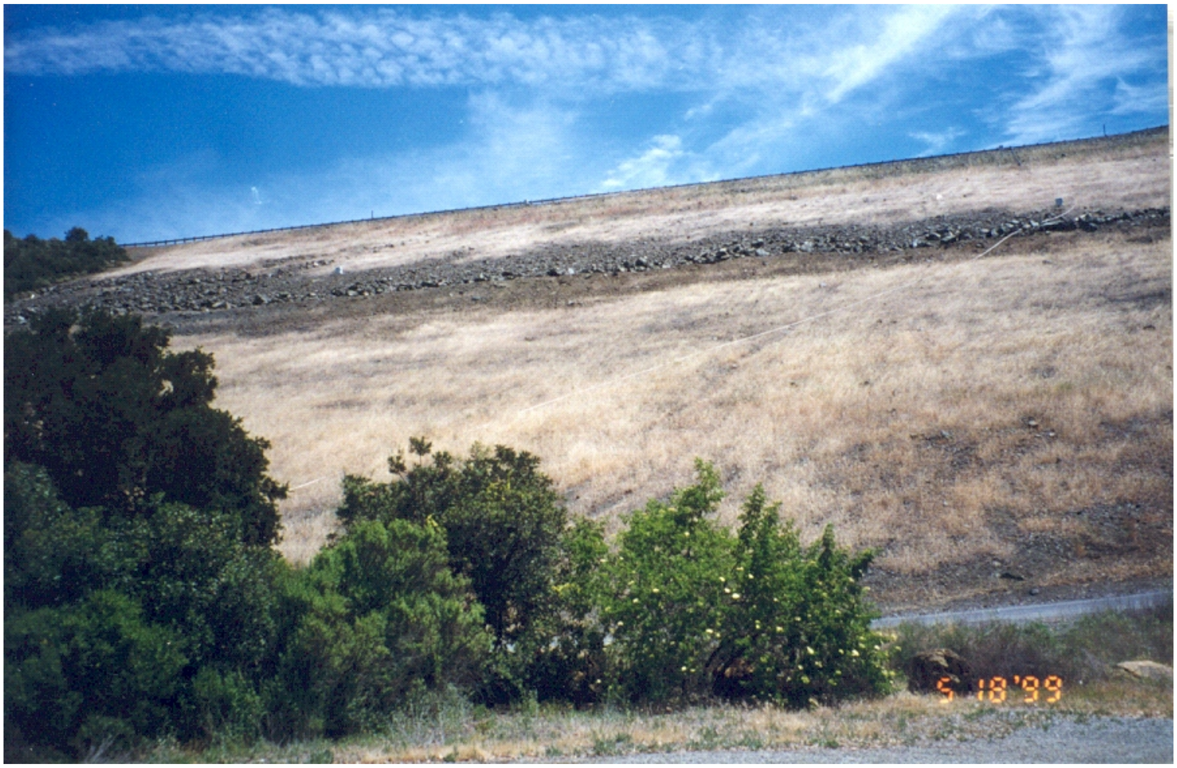


Looking along “line-of-sight” of downstream guardrail (northwestward)



Looking along "line-of-sight" of upstream guardrail

Inspect the dam face (Refer to Figure 1, Appendix C)



Looking at dam face (northeastward)

For the following RED FLAG CONDITION(s):

(A) [ ] Observe the downstream face for slumps, depressions, and seeps
____
____
____

(B) [ ] At the crest, estimate dam crest settlement (vertical displacement)
____
____
____

and lateral movement (either toward the downstream or upstream
Direction)____
____
____

(C) [ ] Describe the extent of crest cracking____
____
____
____

(D) [ ] Walk down downstream right groin, toe, and adjacent natural ground:

Are there any damp areas, seeps, fresh erosion? ________________________________

Any changes in seeps or water discharge in these area?___________________________

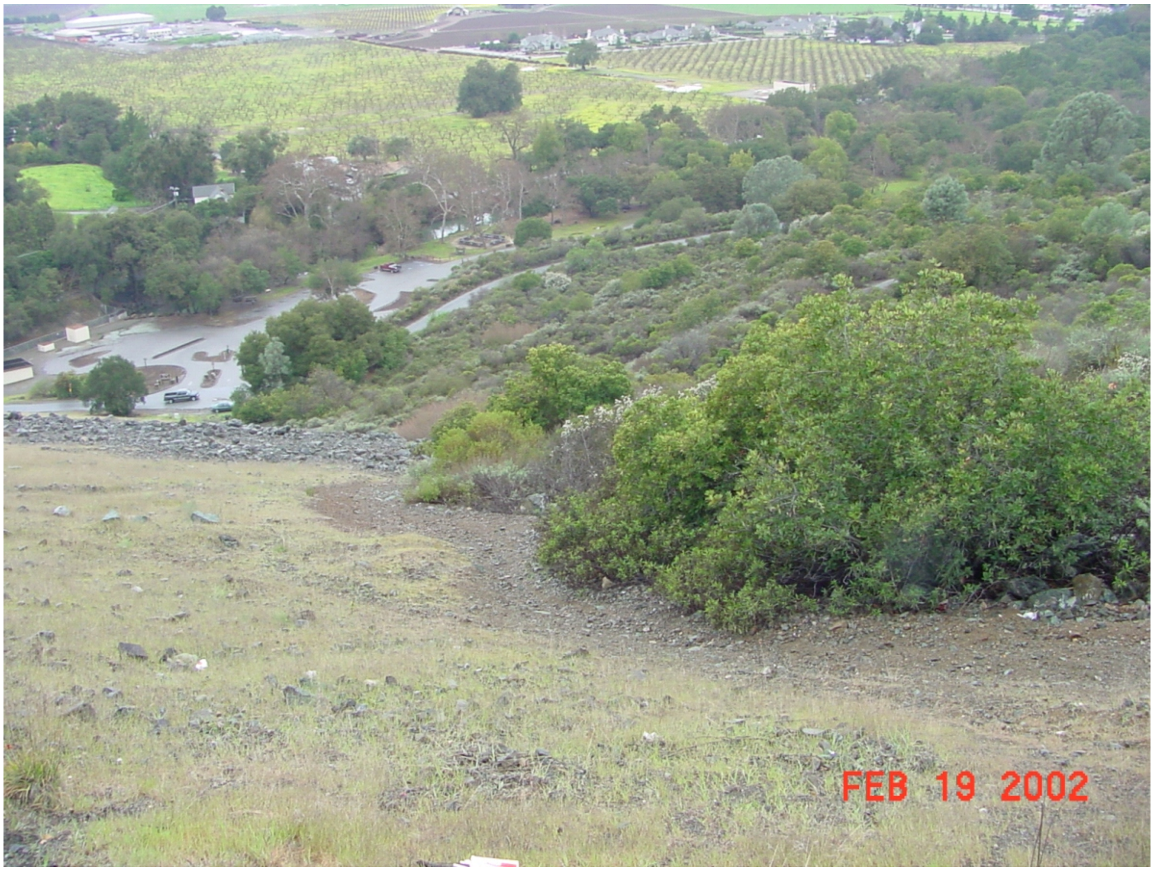
Is discharge muddy or clear?____

Is discharge constant, increasing or decreasing?____

Estimate rate of discharge at first inspection ________date:_________time:_________________

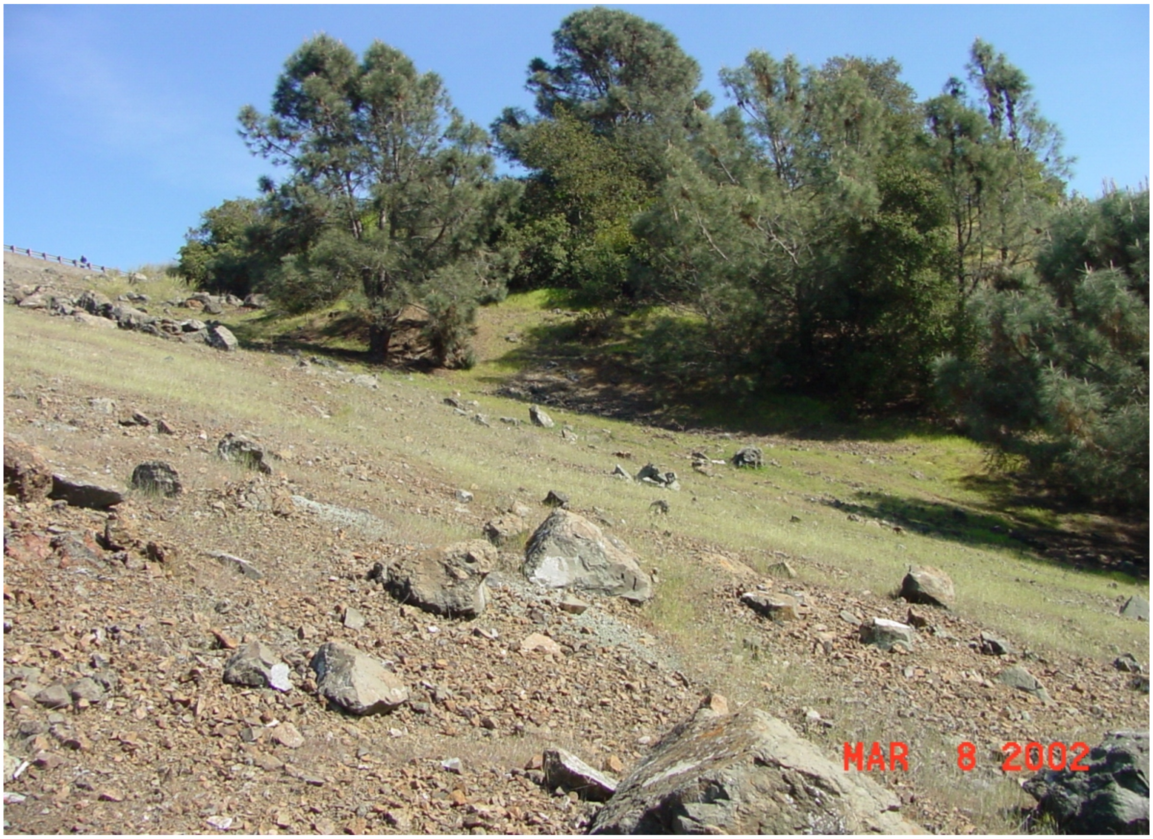
Estimated rate of discharge at later time ________ date:_________time:_________________

Right (North) Groin (looking southwestward)

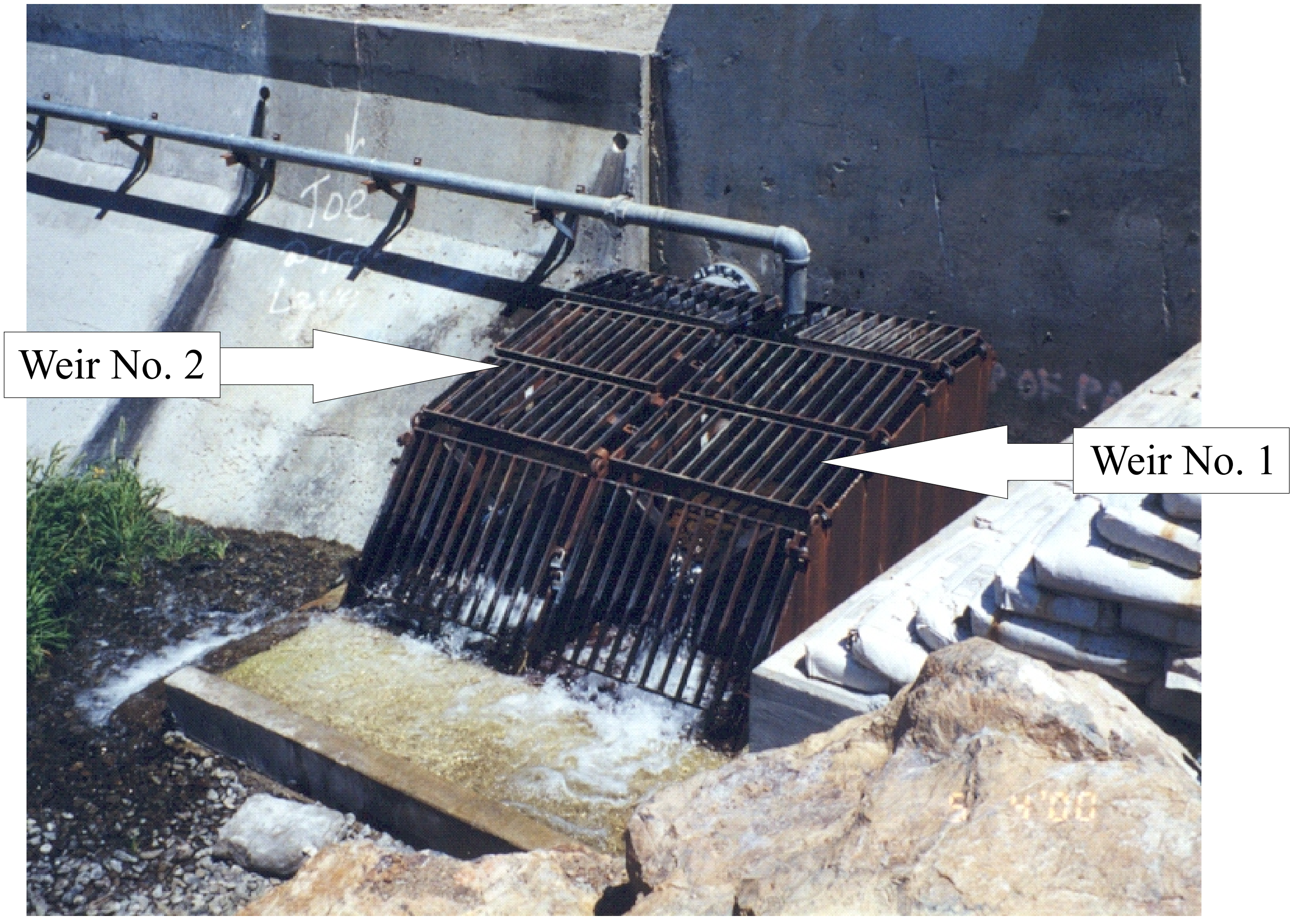


(E) [ ] Walk down downstream left groin, toe, and adjacent natural ground:
Are there any damp areas, seeps, fresh, erosion?________________________________
Any changes in seeps or water discharge in these area?____________________________
Is discharge muddy or
clear?____
Is discharge constant, increasing or
decreasing?____
Estimate rate of discharge at first inspection _________date:_________time:__________
Estimated rate of discharge at later time __________ date:_________time:_________

Left (South) Groin (looking southeastward)



Priority # 3 WEIRS (Refer to Figure 1, Appendix C)



Weirs at spillway terminus (looking eastward)

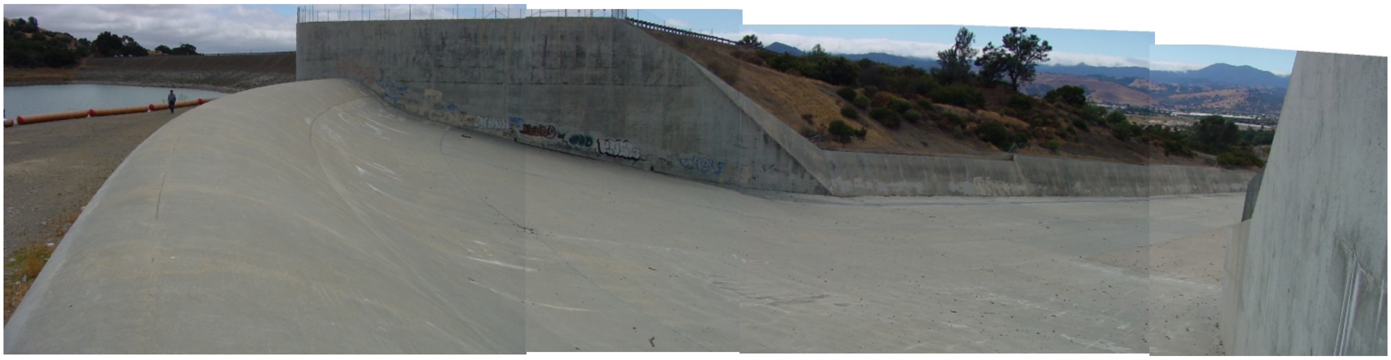
Inspect weirs #1 and #2 for the following RED FLAG CONDITION(s):

(Note: Changes in seepage exhibited by the weirs is indicative of spillway floor seepage only. It is not related to dam seepage and therefore does not necessarily indicate adverse conditions. These observations are for general information only.)

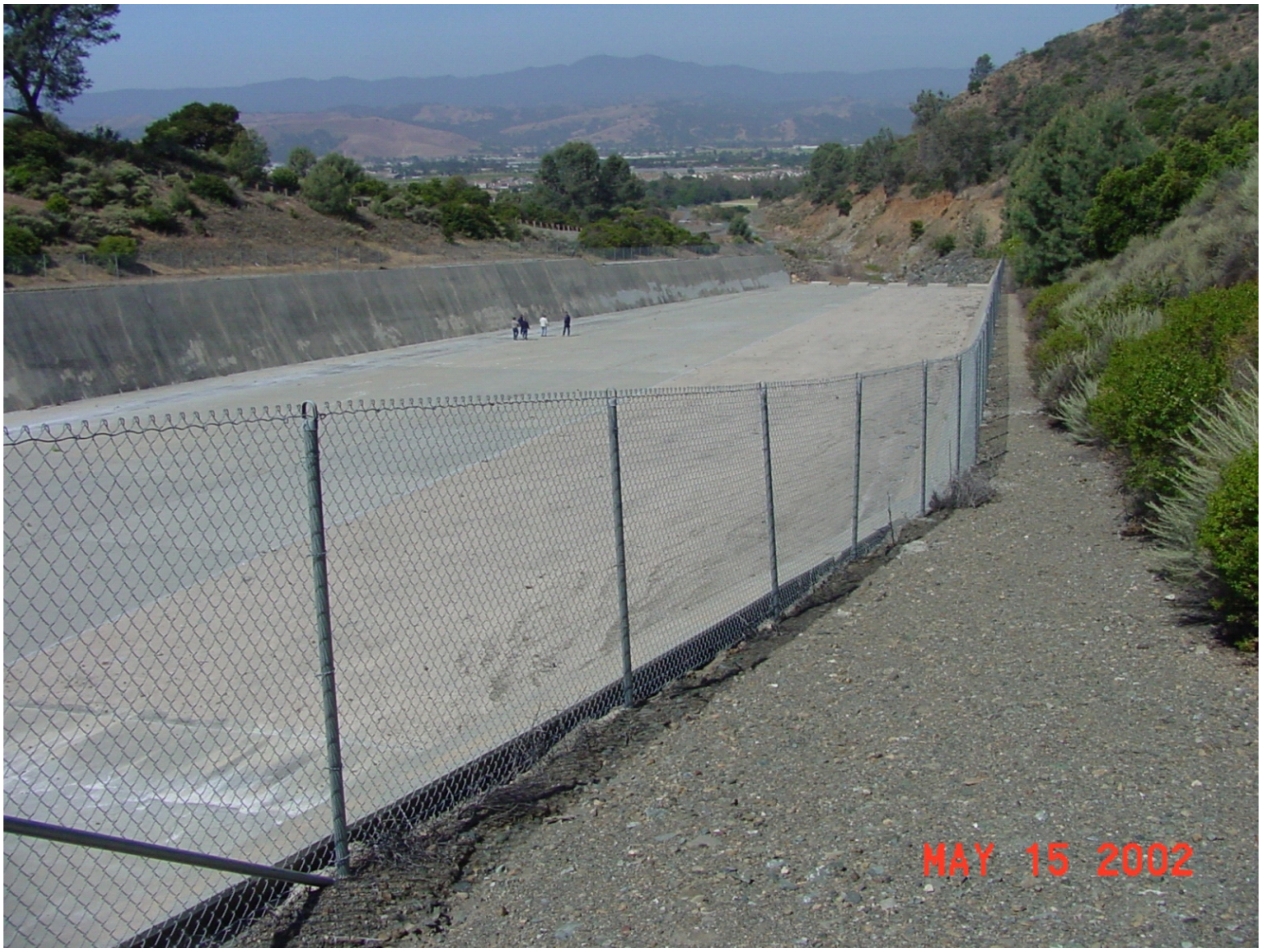
Are there any changes in rate of discharge?____
Is the discharge muddy or
clear?____
Is the discharge constant, increasing or
decreasing?____
Estimate rate of discharge at first inspection:
#1_____#2______date:_________time:___________
Estimated rate of discharge at later time:
#1_____#2______ date:_________time:__________

PRELIMINARY DAM INSPECTION CHECKLIST(S)

Priority # 4 SPILLWAY (Refer to Figure 1, Appendix C)



Looking toward left ogee weir and spillway training wall (southward)



Spillway, Looking downstream (westward)

Inspect the spillway for the following RED FLAG CONDITION(s):

(A) [ ] Does any cracking or distortion exist on spillway ogee weir? ____________________

Circle general area(s) affected on above photo

(B) [ ] Does any cracking or distortion exist on spillway floors or walls?________________

Circle general area(s) affected on above photo

(C) [ ] Are any landslides present on slopes above spillway walls?_____________________

Circle general area(s) affected on above photo

Report filled out by Name:____________Title:____________Date:_______________

Report reviewed by Name:____________Title:____________Date:_______________

Attachment A

Communications Directory

(EOC, County, Key District staff, etc.)

Attachment B

Minimum Equipment List

Radio
Clipboard
Digital Camera
Alpha-numeric pager
etc
etc

Terminology:

Abutment: the sloping valley wall against which the embankment was placed.

Axis: a line along the crest of a dam from one side to another. Usually, as at Anderson Dam, in the center of the crest.

Groin: the line where the embankment fill meets original ground on the left and right abutment.

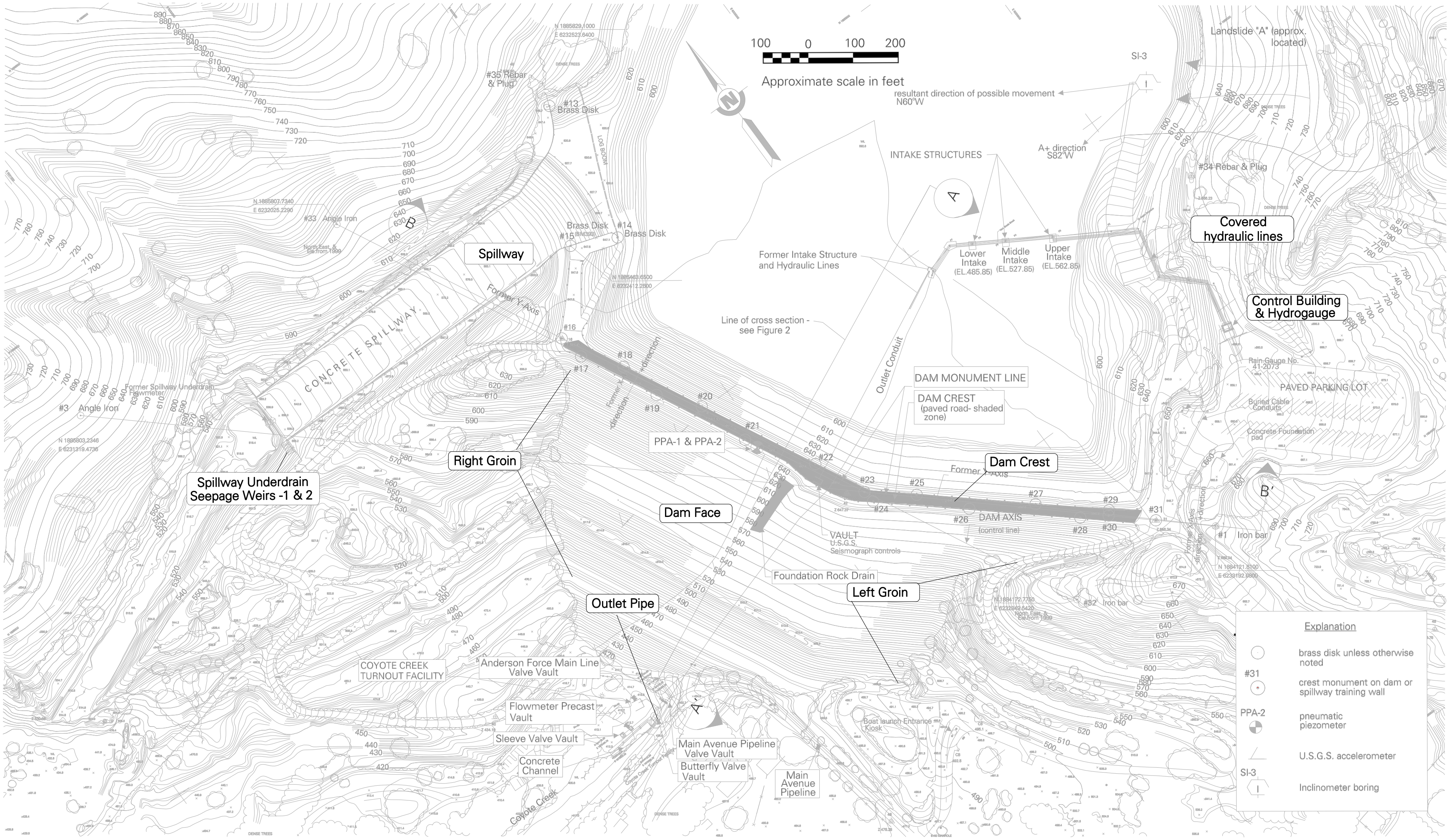
Right and left: always as perceived by a person standing on the crest of the dam, with the reservoir at your back, and looking downstream.

Upstream: the reservoir side of the dam.

Downstream: the spillway side of the dam.

Attachment C

Figure 1. Anderson Dam Site and Vicinity Map



Anderson Dam Site and Vicinity Map - Figure 1

Appendix C